PUBLIC WORKS

Mar.
1958

CITY, COUNTY AND STATE

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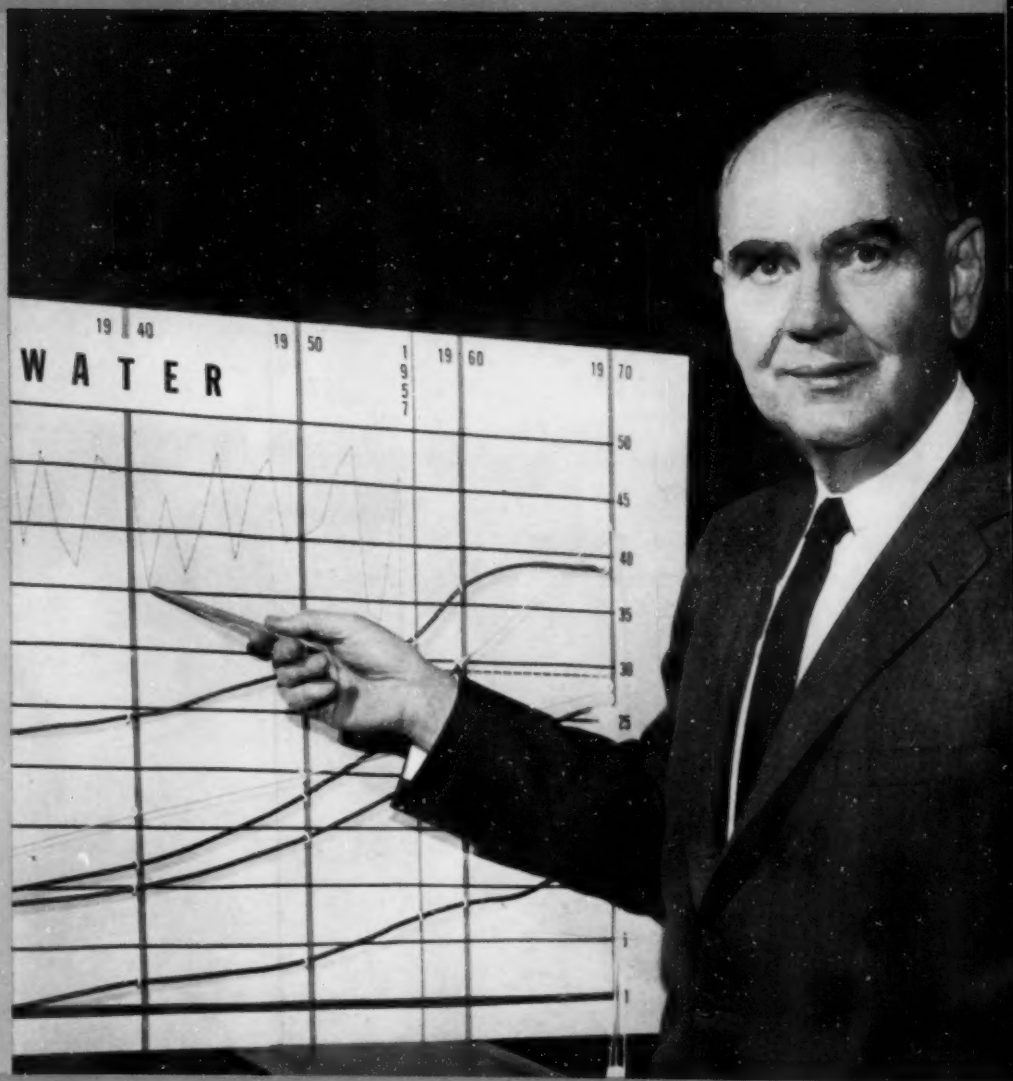

Richard V. Ford, Vice President of the Ford Meter Box Company, is widely known in the water works field. Currently he is serving as President of the Water and Sewage Works Mfrs. Assn. More on page 18.

AND BECAUSE IT IS ECONOMICAL AND EASY TO OPERATE, contractors, state highway departments, counties, cities, villages, and airports use it more than any other roller.

Contractors make it pay for itself over and over when they buy the transport attachment and move it quickly from job to job. Write for literature.

THE GALION 3 to 5 TON VARIABLE WEIGHT TANDEM ROLLER

THE GALION IRON WORKS & MFG. CO.
General and Export Offices—Galion, Ohio, U.S.A.

MOTOR GRADERS & ROLLERS

"from Chicago"

RATED AERATION

SMALL UNIT SEWAGE TREATMENT FOR 20 TO 5,000 PERSONS

- Low Cost
- Expandable — by multiple Units
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- Exclusively successful Standardized Balanced Equipment
- Available in Steel or Concrete Units.

More Than 150 Installations

CHICAGO PUMP COMPANY

Sewage and Industrial Waste Equipment

Subsidiary of Food Machinery & Chemical Corporation

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Kennedy School, Louisville, Ky. • Harstern, Louis & Henry and E. R. Ronald & Assoc., Consulting Engineers • Plant Maintained by School Custodian.

Take it from road foreman Murphy:

"CAT-built machines hold up!"

That's a Cat D6 Tractor 'dozing a new location for a county road north of Deer Lodge, Montana. Nothing unusual about the job, but it inspired a remark worth thinking about. "One thing we have found out about Caterpillar-built machines," said Arthur Murphy, road foreman for Road District No. 1, Powell County, "they hold up."

Take Powell County's D6, for example. 93 flywheel HP, 75 HP at the drawbar, 19,000 drawbar pounds pull (maximum)—these are the surface specifications. Underneath them are such exclusive Caterpillar quality features as:

TROUBLE-FREE POWER from a Cat Diesel Engine designed specifically for the D6, with a fuel system that needs no adjusting, yet operates efficiently on low-cost non-premium fuels.

AN OIL CLUTCH that's maintenance-free, rarely needs even the slightest adjustment.

HEAVY UNDERCARRIAGE that takes the toughest jobs in stride—welded box section construction, heavy track recoil springs, rigid braces.

But don't just take it from Mr. Murphy, or from us. See for yourself, on your own job, what makes Cat-built machines hold up. All you need do is reach for your phone . . .

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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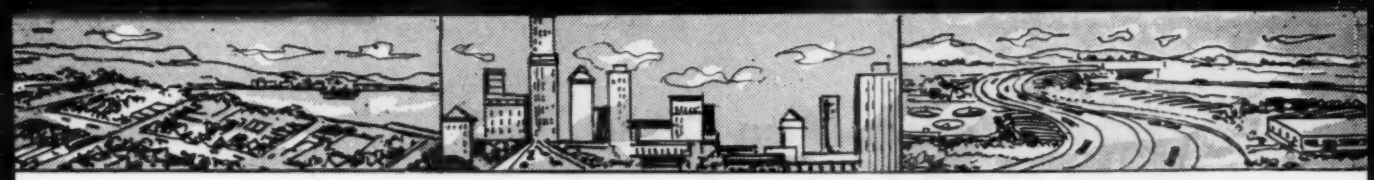
YOUR TAXPAYERS GET THEIR MONEY'S WORTH WITH CAT-BUILT MACHINES



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READERSHIP Eastman RESEARCH

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Established 1896

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EPA

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THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

How a Four-Man Crew laid 1500 feet a day of CLOW Bell-Tite® pipe through Florida swampland

CLOW cast iron pipe, with the sensational Bell-Tite joint, proved its advantages conclusively in this Clearwater, Florida, installation.

That a four-man crew was able to lay this CLOW Bell-Tite pipe at 1500 feet a day under these adverse conditions is definite evidence of the time, labor and money-saving advantages of this CLOW-designed joint. Two men worked in the trench—often in 3 feet of water. One man lubricating and aligning the joints, the other assembling with a pinch bar. A crane operator and a hook-up man completed the crew.

CLOW Bell-Tite forms a pressure-tight joint—instantly—no bolts or follower glands required. Under practically all conditions, it is the fastest, easiest and most economical pipe for water main installation. Underwriters' Laboratories Inc. listed in diameters 3- through 24-inch.

Shows simple assembly of CLOW Bell-Tite joint. Just wipe clean, lubricate and push spigot into the bell. When painted yellow stripe is no longer visible, joint is bottle tight.

Under-water assembly of 8" Bell-Tite pipe at Clearwater, Fla.
Contractor: Hancock Pipe Company, Clearwater, Fla.

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201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:
Eddy Valve Company, Waterford, New York
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POINT OF VIEW

The Case of the Missing Pedagogue

SOME ENGINEERS have a do-it-yourself inclination. In many cases this can be a handicap in getting a first class job done. A case in point is the training of water and sewage plant operators. In very few states has this job been turned over to the state educational authorities, as it should be. The engineer would be properly horrified to have a teacher without engineering training design water, sewage and refuse facilities for his school; but the same engineer blithely assumes that he is capable of planning and implementing a difficult course of instruction despite his lack of training in pedagogy.

A training program, whether for water works, street, sewerage or other personnel, requires pedagogical skills and training as well as engineering. The quicker the engineers and the teachers get together, the sooner will effective training be available. Working together, engineers and teachers can do far more than they can do working each in his own rut.

Highways and Water Supplies—Both are Indispensable

THE HIGHWAY INDUSTRY has presented so clearly the need for a comprehensive and modern system of highways, that some $25 billion dollars or more have been earmarked for a nation-wide program. The cost of construction will be paid for by taxes on the road users.

In view of the similar great need for conservation of our national water resources, consideration might be given to developing a generally similar nation-wide program which would start with intensified stream pollution control. A tax levy on sewage flow volume, possibly based on effluent quality, might cover all or part of the cost of such a program; and by encouraging water conservation through reduction of sewage flow, it could tend to reduce the intensity of need for the development of new or increased supplies.

Salvage from Refuse is Desirable But Rarely Practical

BECAUSE WE KNOW our readers are interested in the possibilities of salvaging some of the values that undeniably exist in municipal refuse, we have published considerable information on the subject. We do not feel it has been shown so far, that, in the United States, it is practical for a city to make money, or even to reduce materially the cost of refuse operations by such procedures. In some areas, composting by a private organization, with adequate sales facilities, can be made to yield a profit; and there is, of course, no question of the desirability of conserving the values in refuse. Nevertheless, we believe that our present greatest need in the refuse field is storage in tight containers, well covered; better collection by modern equipment; and better disposal by incineration or sanitary fill.

Research now under way on the composition and characteristics of refuse may provide information needed for wider use of salvage methods, whether composting, grinding and recovery of sludge gas and solids, or sale of materials gleaned from the refuse. But no city can afford to wait very long, meanwhile relying on those methods which ought to be outlawed everywhere—the open dump and feeding to swine.

The Importance of Shoulder Maintenance

THAT PORTION of the road structure which separates the pavement from the surrounding landscape presents an admittedly big problem in any highway maintenance program. The role that the shoulder performs in providing safety for the road user justifies a sound approach, for a poorly maintained shoulder is perhaps worse than none at all. This is especially true under northern winter driving conditions. When a snow-covered road is plowed, unless the full width of the pavement be exposed, it is impossible for the motorist to tell what is in store for him if he, accidentally or under stress of traffic conditions, gets off the pavement. Too often what he finds is bad, resulting in a skid, spin or complete loss of traction.

Highway maintenance crews have enough to do during winter weather, but an early job ought to be inspection of all shoulders for winter hazards; a spring program for proper maintenance; and a late fall inspection to assure readiness for the coming winter. A good inspection form, written reports and recommendations and a follow-up system to insure needed work has been done are essentials.

Lots of people have to use our highways, in sun, rain or snow; and it is the job of the highway engineer to see that their travel is safe and reasonably speedy.

DOLLAR

Ash disposal line for power plant in Alabama, being constructed with 12" Mechanical Joint Cast Iron Pipe.

Big Business, too, chooses Cast Iron Pipe

Fire protection line for large automotive plant in New Jersey, built with Mechanical Joint Cast Iron Pipe.

MODERNIZED **cast iron**

FOR DOLLAR

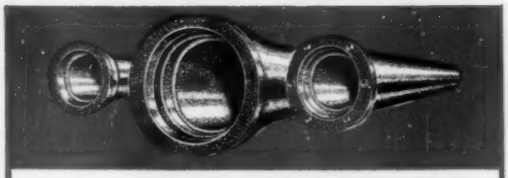
Cast Iron Pipe delivers MORE water...LONGER!

Pipe is a capital investment.

But cast iron pipe is an investment that pays off.

- *In longer life* . . . cast iron pipe serves for centuries.
- *In more efficient operation* . . . cast iron pipe requires little or no maintenance or replacement.
- *In taxpayer satisfaction* . . . cast iron pipe far outlasts the bond issue that paid for it.

Most important to you, these statements are based on proof, not claims . . . performance, not promise. Specify cast iron pipe, America's most dependable pipe, and be sure, not sorry.



6 reasons why Cast Iron Pipe is #1 choice of U. S. A.

1. **HIGH FLOW CAPACITY . . .** Cement lined cast iron pipe and fittings will not tuberculate . . . delivers a full flow for the life of the pipe.
2. **LONG LIFE . . .** 42 North American cities are still using cast iron water mains laid 100 years and more ago. Hundreds more have passed the 50 year mark.
3. **BEAM STRENGTH . . .** Cast Iron Pipe is inherently tough . . . stands up under heavy traffic load, soil displacement and disturbance.
4. **EXTERNAL LOAD RESISTANCE . . .** 6" Class 150 Pipe withstands a crushing load of 17,900 pounds per foot . . . nearly 9 tons.
5. **CORROSION RESISTANCE . . .** Cast Iron Pipe effectively resists corrosion . . . vital factor in its long life and dependability.
6. **TIGHT JOINTS . . .** A full range of leak-proof, low cost, easy-to-assemble joints for pipe and fittings are available for all conditions.

THE MAN WHO CHOOSES CAST IRON PIPE TODAY WON'T PAY FOR IT AGAIN TOMORROW!

CAST IRON

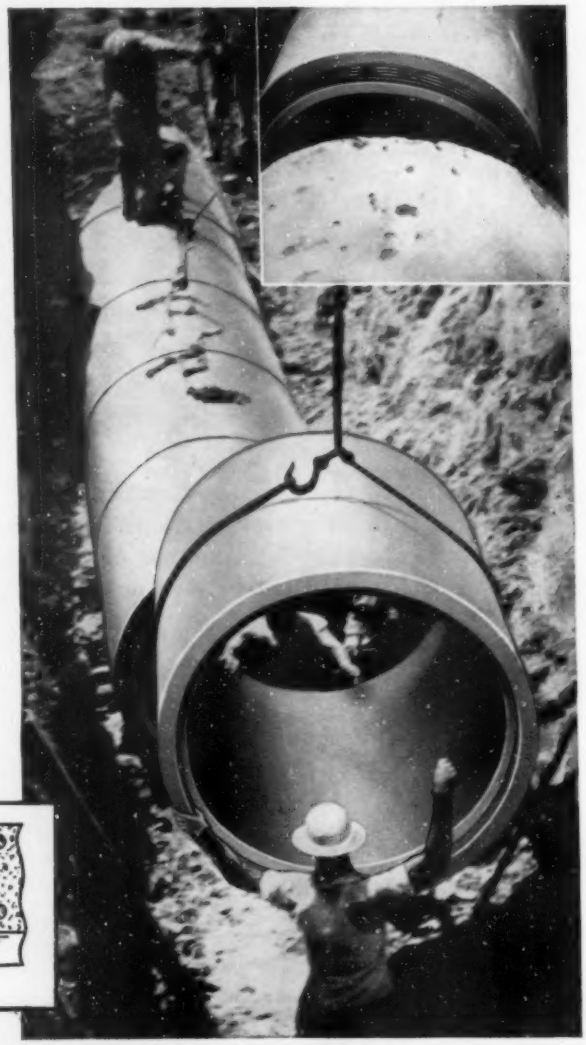
Cast Iron Pipe Research Association
Thos. F. Wolfe, Managing Director
Suite 3440, Prudential Plaza, Chicago 1, Ill.

pipe FOR MODERN WATER WORKS

No one wants to DIG UP a sewer line . . .

THIS ONE IS "LEAK-PROOFED FOR LIFE"* WITH

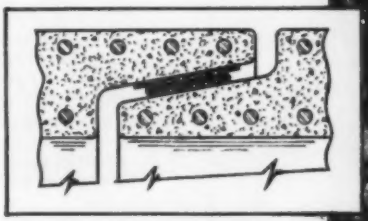
TYLOX *flexible* RUBBER PIPE JOINTS



This sewer line in *CORPUS CHRISTI, TEXAS won't have to be dug up in a few years because of leaky or failing joints! In specifying TYLOX Rubber Gaskets, engineers and city officials took advantage of a coupling material **known** for its non-deteriorating, ageless qualities . . . for its ability to make sewerage and drainage pipe joints leak-proof and root-proof for the life of the pipe itself.

But that's not all . . . along with the certainty of permanently water-tight pipe joints, their TYLOX specification assured faster construction and lower job costs. **Flexible** TYLOX is quickly assembled to the pipe, and permits fast assembly of the line. It compensates for pipe angularities . . . permits wet trench jointing . . . immediate backfilling.

TYLOX is the **one** pipe joint that meets the requirements of engineers, sanitary officials and construction men alike. Specify TYLOX on your pipe jobs.



This rubber-tight seal STAYS tight "for the life of the line".

5032

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St. Orchard 3-9555

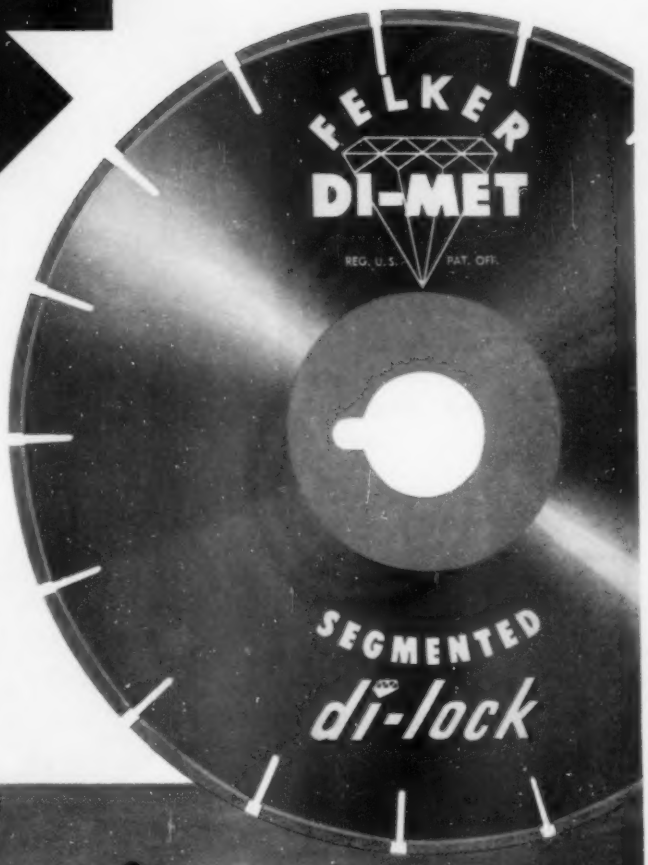
* PROJECT: 48" trunk sewer for City of Corpus Christi, Texas

ENGINEERS: For City of Corpus Christi, Texas — Drahn Jones, Dir. of Public Works, and Klyde Z. Huston, Engineer

CONTRACTOR: Heidenfels Bros., Corpus Christi, Texas

PIPE: TYLOX-Jointed, reinforced concrete, furnished by TexCrete Company, Corpus Christi, Texas

GREEN CONCRETE



In a recent test cutting 3 day concrete, one Felker DI-LOCK diamond blade cut a total of 8,000 feet 1" deep against 3,500 to 5,000 feet for competitive blades cutting to the same depth! Aggregate was gravel, flint and quartz. Blades were all operated on the same 36 h.p. concrete cutter and on the same job.

THIS IS ANOTHER TYPICAL CASE HISTORY OF DI-LOCK SUCCESS—

Reports keep pouring in from all over the nation with the same impressive facts... *more footage, faster cutting, greater economy per blade!* If you want lower cost per cut there's one *sure* answer proved by contractors from coast to coast! Specify Felker DI-LOCK'S, America's *longest-lived* diamond blade!

See your Felker Distributor or write for information.

Full line of Felker Concrete Cutting Machines! Illustrated: Felker Model 367-36 h.p.

First in Diamond Cut-Off Blades!

FELKER DI-MET SINCE 1924

FELKER MANUFACTURING CO.

Torrance, California

Consulting Engineers,
L. I. Couch Co., Indianapolis, Ind., and Carl J. Heim, Jasper, Ind.

Construction by,
Olinger Construction Co., Huntingburg, Ind.

Huntingburg, Ind.
sewage treatment plant. Photo right shows both floor and side wall blocks of clay; also vent cover block, channel covers and sewer pipe vents ready to install.

TFFI

SYMBOL OF GOOD TREATMENT

TRICKLING FILTER

TFFI members supply vitrified clay under-drain blocks that even exceed ASTM requirements.

Suggested specifications may be had from any member of the Institute. Ask for copy of approved specifications, ASTM C 159-55.

. . . and still the trend grows to trickling filters with

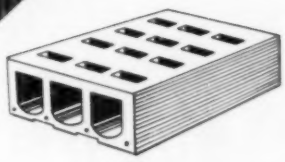
TFFI specification vitrified clay underdrain blocks for sewage treatment plants

BECAUSE—they combine these big advantages:

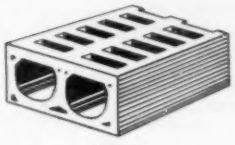
Permanence with protection against acids, alkalies and bacterial actions that no blocks made from a substitute material can possibly give. Ask us about our 50-year guarantee of vitrified clay blocks. Also blocks made of vitrified clay are superior because they are manufactured under rigid controls usually impossible with substitutes.

PLUS THESE FURTHER IMPORTANT ADVANTAGES OF TRICKLING FILTERS:

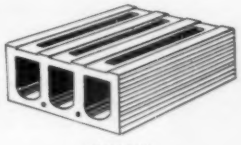
Low first and operating costs. Simple, easy operation. Long life—longer than that of the bonds issued to pay for the plant. Overload is no problem. Good results: top-notch effluent, day in and day out. Flexibility and adaptability.



DICKEY
W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.

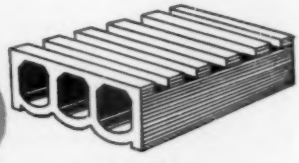


BOSCO
Bowerston Shale Co.
Bowerston, Ohio

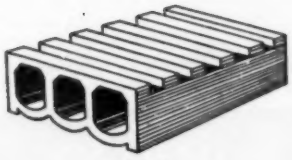


POMONA
Pomona Terra-Cotta Co.
Pomona, No. Car.

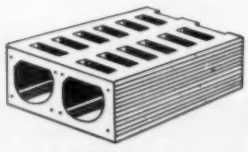
FLOOR INSTITUTE



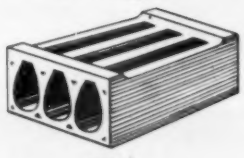
TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas



TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.



ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



NATCO
Natco Corporation
Pittsburgh 22, Pa.

POWERS American

SERIES LM-4

"Load-Master"

HYDRAULIC CRANE

Saves time and manpower because it speeds up loading and unloading jobs... handles work normally requiring several specially-equipped vehicles.

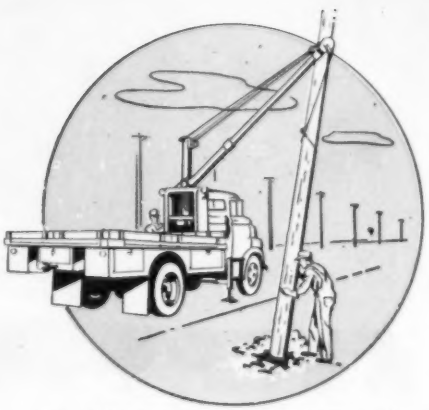
Load-Master lifts a 4000 lb. load with ease... moves it safely and quickly under the most adverse job conditions. Power is derived from a heavy-duty hydraulic pump driven by the truck engine. Controls are located in a position which gives operator full view of the crane at all times.

Operator has absolute control of load at all times. The hydraulic system requires intentional movement of control levers before load position can be changed... and the load cannot drop if the truck engine stalls.

OPERATING FEATURES: Telescopic-type hydraulic boom can be spotted at any point from horizontal position to an 85° angle of elevation; hydraulically-powered mast will turn 360° in either direction; specially-designed winch, driven by a hydraulic motor, is grooved to wind cable evenly; hydraulic outriggers, with swivel-mounted foot plates, furnish extra side stability.

Load-Master is ideally suited for use with the Powers-American Series 300 Body shown above. It can also be furnished with bodies of other types... or shipped for mounting in your shop or local garage.

PRICE INFORMATION AND DESCRIPTIVE LITERATURE WILL BE SENT UPON REQUEST.



Load-Master can be used for setting poles up to 45' in length. It requires only 20" of mounting space behind the truck cab. Boom extensions to 22' can be furnished.

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY
ST. LOUIS 15, MO.

625 CEDAR STREET
BERKELEY 10, CALIF.

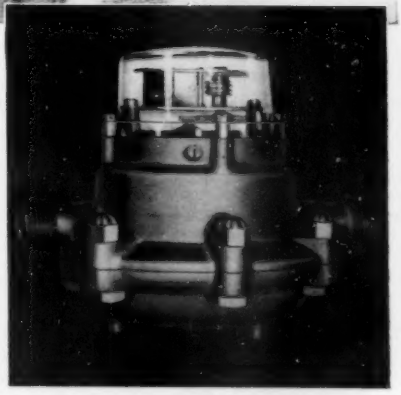
WATER DEPARTMENT, CHIEF ENGINEER

PLANNER OF OPERATIONS, JUDGE OF QUALITY

He says, "I recommend American Meters because of their advanced engineering, their simplicity and complete frost protection."

Men who have an engineering background appreciate the advanced design features of American Meters. They know that such features as the simplicity, the ruggedness, the thicker measuring disc, the transparent hard tenite plastic register cover, the "O" ring stuffing and packing, the ease of disassembly and assembly are the result of sound engineering knowledge and years of meter experience.

"Yes . . .", as Chief Engineer of the Water Department, "I recommend American Meters every time."



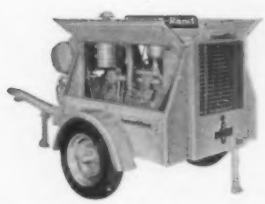
Use American Meters with sealed plastic register box for pit installation.

BUFFALO METER CO.

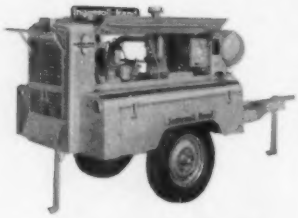
2920 Main Street • Buffalo 14, New York

CUT MUNICIPAL MAINTENANCE COSTS

with a GYRO-FLO compressor that's MATCHED TO THE JOB!



85 CFM GYRO-FLO



125 CFM GYRO-FLO

210 CFM GYRO-FLO

Here's how many Ingersoll-Rand air tools you can operate with each of these compressors:

Utility Jackhamers	3	5	8
Medium Jackhamers	1	2	4
Heavy Jackhamers		1	3
Light Paving Breakers	2	3	6
Heavy Paving Breakers	1	2	4
Diggers	2	3	9
Backfill Tampers	3	5	10
Impactools (3/8" Bolt Size)	5	8	16

On practically *any* street maintenance or construction job, AIR POWER saves time, effort and expense. But for maximum efficiency and economy you need a compressor that's the right size for the tools you want to operate – large enough to deliver full pressure at the tools, yet small enough to avoid excess horsepower and unnecessary fuel costs.

With the Ingersoll-Rand line of GYRO-FLO portables, you can match the compressor to any job – from the smallest to the largest. The three sizes most suitable for general municipal service are shown here. In addition, the I-R line includes units of 315, 600 and 900 cfm, for the really big air power jobs.

But whatever size you select, a GYRO-FLO gives you the last word in dependability, operating economy and exceptional freedom from maintenance. The GYRO-FLO rotary design, developed by Ingersoll-Rand, has proved its outstanding performance and low overall cost in years of on-the-job service all over the world. Ask your I-R dealer or representative for complete information on the units best suited to your needs.

Ingersoll-Rand

2-785 11 Broadway, New York 4, N. Y.

COMPRESSORS • ROCK DRILLS • AIR TOOLS
CARSET BITS • PUMPS

NEW

...and Sure to Win Their Way to the Heart of Industry

Many optional features, including built-in power steering, add to the versatility of the "440" Wheel-Type.

Ruggedness, power, operator's comfort, and all-around economy are featured in the new "440" Crawler.

JOHN DEERE "440" Industrial Tractors

NEW Styling Throughout . . .

NEW Long-Life Construction . . .

NEW Operator Comfort, Convenience, and Protection . . .

NEW Operating Advantages . . .

NEW Ease of Adjusting and Servicing . . . All-Around Economy.

Worthy "Stablemate" of the Popular "420"

Every inch another "thoroughbred," the new John Deere "440" is a worthy "stablemate" of the ever popular John Deere "420," the busy, capable, and economical crawler that continues to merit the praises of efficiency-minded industrial users everywhere.

With a capacity for work that must be seen to be believed, combined with a nimbleness that cuts maneuvering time drastically, they have the ability to squeeze more work out of every piece of equipment and to press more work into every hour.

HERE they are . . . trim and eager . . . and literally "born" to save you money, whatever business you're in—the New John Deere Industrial Tractors.

"Born" to save you money?

We could hardly put it better. For these are INDUSTRIAL tractors from top to bottom . . . ruggedly built from grille to drawbar . . . and designed, inside and out, to fill definite needs in industrial work of all types . . . to cut to rock bottom the costs of such jobs as earth moving, materials-handling, sand and gravel work, mowing, maintenance, and many other—often specialized—jobs in contracting, construction, utilities, manufacturing, and public works.

Both tractors are built around an amazingly efficient John Deere engine, unmatched for delivering so much, for so long, for so little cost. Both have many construction features of hood, grille, frame, and either wheel or track assemblies—plus optional new clutch-type direction reverser—that enable them to do more than their share of the day's work of pushing, pulling, lifting, digging, and hauling. Their clean, modern, functional design throughout makes them businesslike in operation, easy to service and economical to maintain. A line of proved, matched working equipment gives them the versatility that industry demands.

Size up these modern tractors in the light of your requirements. It may be the start of making your power dollars go farther than you thought possible.

JOHN DEERE Industrial Tractors and Equipment

Completely Engineered for Industry

For Further Information Write: JOHN DEERE INDUSTRIAL DIVISION · MOLINE, ILLINOIS

Municipal Water Filter Installation cost can be cut 1/2 to 1/3 with...

★ This Filter is also used extensively for swimming pool and industrial plant water filtration.

SPARKLER *Diatomite* **FILTERS**

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL SCJ because:—

1. The original cost of a diatomite plant for public supply is ½ to ⅓ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces the chlorine demand of the water by removing organic matter to an exceptionally high degree. The overall bacteria reduction in the effluent is from 80% to 90%. Sterilization of the finished water can be accomplished with much less chlorine. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.

Less than 0.2% of water is required to sluice and clean the Model SCJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

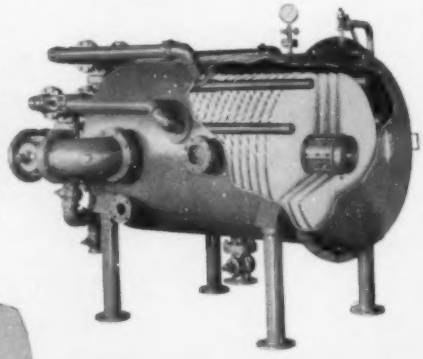
Operators can be easily trained to handle this filter, no highly skilled specialized personnel is required to insure efficient performance.

Sparkler Model SCJ filters can supply practically any required volume of city water. Single units with a capacity of 5,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.

Interior construction of Model SCJ Water Filter. Sparkler filtration engineers have introduced, in the SCJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced innovations in recent years.

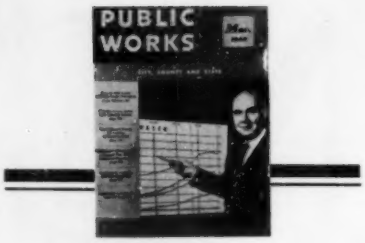


SPARKLER FILTERS

SPARKLER MFG. CO., MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

FILTRATION ENGINEERING AND MANUFACTURING EXCLUSIVELY FOR OVER 35 YEARS.



Richard V. Ford has so many jobs and titles that they cannot be listed in the first sentence of this paragraph; and, indeed, not even in a good-sized paragraph. To start at the beginning, he is a Hoosier, born in Hartford City, Ind., and attended Purdue, where he was graduated with a degree of BS in Chemical Engineering in 1922. In Purdue he was a member of Scabbard & Blade and editor of the Purdue Engineering Review. Until 1928, he was with Worthington Corporation; then he went with his brothers in the Ford Meter Box Co., and has been with them ever since, now serving as Vice President.

He has had a hand in all of the developments of his company; the Yokebox and the Fiberforms were largely his own work; and he did the development work on the Testerate Indicator. He has represented Ford Meter Box Co. in the East for a long time, residing in Haddonfield, N. J., where he participates in many civic affairs.

In chronological order, but not order of importance, he saw service in the infantry in World War I; he was married to Mildred Carlson in 1925 and they have three daughters and several grandchildren; in World War II he was in the Navy (though offered a commission in the Sanitary Corps). He served for four years, has remained in the reserve and now holds the rank of Commander. He served as Director of the Water and Sewage Utility and Industry Division of the BDSA of the Dep't. of Commerce and is now an Executive Reservist. He is currently President of the Water & Sewage Works Mfrs. Ass'n.; a director of the Purdue Alumni Ass'n. from this area; a trustee of the Haddonfield Methodist Church; an author, often anonymous; Secretary of the AWWA Task Group on Rating Scales for Water Works; and a member of more associations than we can possibly list here. Generous with his time, his skills and his contributions to many worthwhile subjects, it is a pleasure to have his picture on the cover.

standardize on MUELLER®

AWWA fire hydrants and gate valves

For assured dependability, standardize on Mueller AWWA Fire Hydrants and Gate Valves for municipal, industrial and private fire protection and water supply systems. Precision-engineered, these products equal or exceed the exacting specifications of the American Water Works Association.

MUELLER CO.
DECATUR, ILL.

AWWA Improved Fire Hydrants

Bronze Weather Cap — prevents freezing of operating nut and eliminates tampering.

Individual Non-kinking Chains — no interference with other caps.

Fluted Design—ribs add strength at flanged joints.

Concealed Flanges—keep out dirt and improve appearance.

Brilliant Enamel Finish—aids recognition and resists weather.

Pitch Tar Varnish Finish—resists corrosion below ground.

Tapered Lower Barrel — prevents frost heave.

AWWA Gate Valve

Heavy Cast Iron Body — ample strength to withstand pipe movement.

Pitch Tar Varnish Finish — resists corrosion.

Cadmium Plated Bolts and Nuts — give greater resistance to corrosion.

Fully Bronze Mounted — reduces wear and corrosion.

Parallel Seat—Double Disc Type — preferred for water works use.

Four Point Wedging Mechanism — assures positive shut-off.

Pinned Disc Assembly — valve operates in any position.

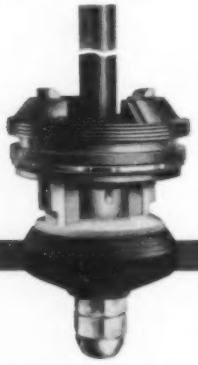
MATCHED IN QUALITY . . .

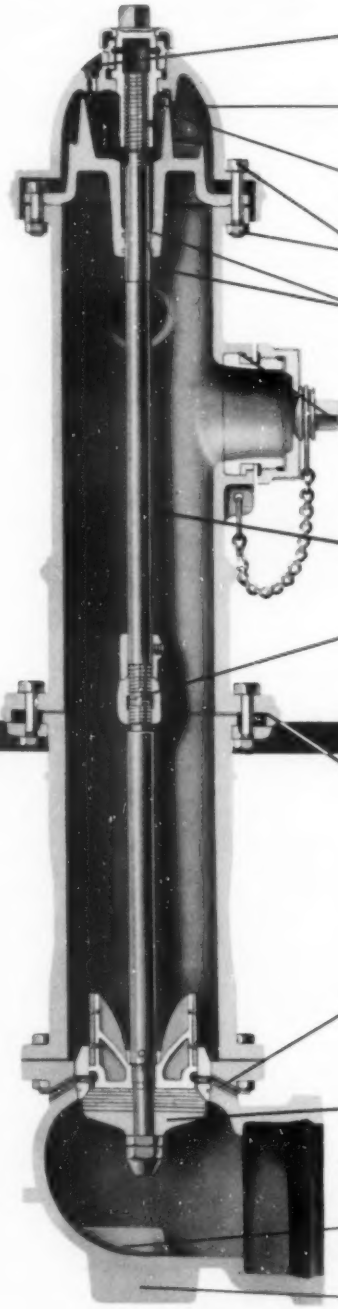
MUELLER

AWWA improved fire hydrants

Compare the many features of Mueller Fire Hydrants with those of ordinary hydrants. Compare the standard features . . . then compare the exclusive bonus features that have given Mueller Fire Hydrants an unequaled reputation of dependability and safety. Compare—and you, too, will standardize on Mueller AWWA Improved Fire Hydrants.

designed for above-ground maintenance!





- **Double Drain Valves** . . . integral part of main valve assembly to give positive, automatic operation without springs, toggle joints or synchronized mechanisms.
- **Resilient Balata Valve** . . . layers of canvas impregnated with Balata resist wear and rock damage and insure a positive shut-off.
- **Bronze Seat Ring** . . . fine threads and copper-asbestos gasket prevent leakage around seat ring in both open and closed position. Straight threads permit easy removal from above-ground. Gasket comes out with seat ring.
- **Bronze Cap Nut** . . . seals bottom of stem and stem threads from water to reduce corrosion.
- **Pin and Guides** . . . prevent stem from rotating during operation of hydrant and eliminate tendency of stem to unscrew from main valve.

- **Oil Filler Plug** . . . permits instant check of oil level with dipstick. Oil may be added without removing bonnet.
- **Oil Reservoir** . . . provides positive lubrication of all stem threads and bearing surfaces each time the hydrant is operated.
- **Dry Top Design** . . . threads and all bearing surfaces are sealed away from the water in the barrel.
- **Cadmium Plated Bolts and Nuts** . . . give greater resistance to corrosion.
- **"O" Ring Seals** . . . give permanent, water-tight seal by bearing against a bronze sleeve brazed to the top of the stem. Packing adjustments, binding of stem, stuffing box bolts and glands are completely eliminated.
- **Breech-Locked Nozzles** . . . four lugs lock bronze nozzle into barrel with a ⅛ turn to positively prevent blow-out. Nozzles are then calked with lead.
- **Full Flow Opening** . . . large radius hose and pumper openings reduce frictional loss to a minimum.
- **Safety Stem Coupling** . . . opens up to prevent damage to stem when hydrant is hit by a vehicle. Can be replaced in minutes without water shut-off.
- **Safety Flange** . . . breaks cleanly to prevent barrel breakage when struck by a vehicle, yet is strong enough to withstand normal use, shipping and testing. Permits economical repair, adding of extension sections, rotating of upper barrel section, changing of upper barrel section for different nozzle arrangements—all without digging or water shut-off.
- **Double Drain Openings** . . . fully bronze mounted. Annular drain groove in seat ring connects drain openings in ring and shoe. Openings are momentarily force-flushed each time hydrant is operated.
- **Compression Type Main Valve** . . . closes with the pressure—and stays closed without strain on stem. Permits repairs and changes of upper barrel section and operating mechanism without water shut-off.
- **Positive Stop** . . . integrally cast into shoe permits full opening without over-travel of stem.
- **Heavy Shoe** . . . designed for full flow with pedestal base and backing pad for ease in setting and blocking to prevent blow-off.

. . . . DEPENDABILITY

• **"O" Ring Stem Seals** . . . upper "O" ring seals dirt and water from bearing surfaces and acts as a reserve pressure seal. Bottom "O" ring provides a positive water-tight seal to prevent external leakage. The higher the pressure, the greater the sealing force. Conventional packing may be easily converted to "O" ring stem seals.

• **Lubricant Reservoir** . . . the area between the "O" rings is filled with a special, lifetime lubricant. Each time the valve is operated, both "O" rings are completely lubricated. The thrust collar operates in an oil bath.

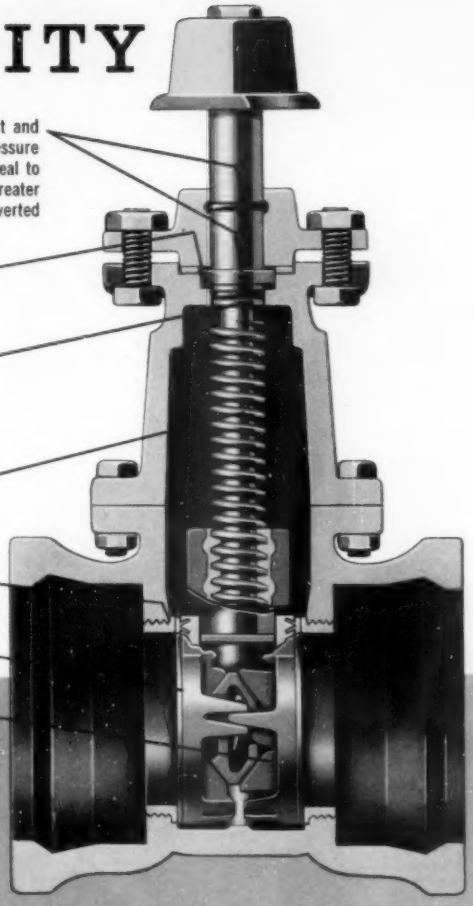
• **Heavy Bronze Stems** . . . are machined from high tensile strength solid bronze rod for all valves up to 16". Electrically upset thrust collar improves grain structure. Valves 18" and larger have stems cast from extremely high tensile strength manganese bronze.

• **Acme Stem Threads** . . . combine high strength and efficiency with self-cleaning ability.

• **Bronze Seat Rings** . . . accurately machined and threaded into body. May be replaced, if necessary, with the proper tools.

• **Bronze Disc Rings** . . . are rolled-in to become part of the disc and are then machined for precise mating with the seat rings.

• **Four Point Wedging Mechanism** . . . exerts even pressure at four points near the outer edge of each disc to eliminate disc deflection and distortion and to assure tight shut-offs. See illustration below.

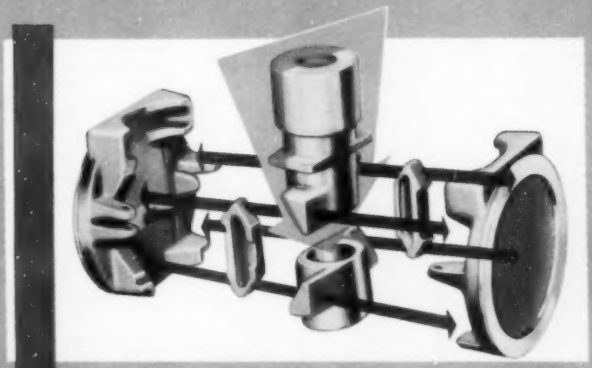


MUELLER

AWWA gate valves

You can forget about the gate valves in your water supply and fire protection systems when they're Mueller Gate Valves. Long-life features, dependability features, ease of operation features add up to maintenance-free service.

designed for minimum maintenance!



• **Exclusive Disc Movement** . . . discs move in an inverted "T" manner, as shown, when valve is opened or closed. The entire disc and wedging mechanism is held together as a unit by special bronze pins passing through interlocking lugs that are cast integrally with each disc. This permits operation of valve in any position. These pins and lugs also control the amount of disc movement. By maintaining a minimum of clearance, discs positively shear incrustations and deposits from seat ring upon closing. Yet, there is no abrasive sliding and scraping contact between disc and seat rings.

• **Husky Wedge Nut Flange** . . . supports entire gate assembly in perfect alignment without strain on wedging mechanism.

• **Opposed Wedges** . . . on top nut eliminate binding or twisting of stem. Nut is free to rotate and the only forces on the stem are straight up or straight down.

whatever your needs

specify **MUELLER**

AWWA IMPROVED FIRE HYDRANTS

- Working pressure: 150 p.s.i.
- Test pressure: 300 p.s.i.
- Inlet ends: Hub, Flanged, Universal, Mechanical Joint, "Ring-Tite" and "Fluid-Tite".

Two Way
Sizes: 4¼", 4½", 5¼", 6¼"

Three Way
Sizes: 4¼", 4½", 5¼", 6¼"

AWWA GATE VALVES

- **Working pressure:** 175 p.s.i.—2" through 12"
  150 p.s.i.—14" through 48"
- **Test pressure:** 300 p.s.i.

Non-Rising Stem

"O" Ring Seals through 36" size without gearing

Conventional packing available on all sizes with or without gearing

Combinations of most end connections available

Hub Ends
Sizes: 2" through 48"

Flanged Ends
Sizes: 2" through 48"

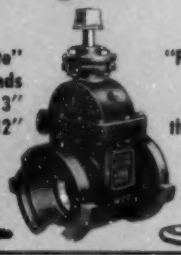
Spigot Ends
Sizes: 2" through 12"

Mechanical Joint Ends
Sizes: 2" through 24"

Universal Ends
Sizes: 2" through 24"

Screwed Ends
Sizes: 2" through 8"

"Right-Tite" Ends
Sizes: 3" through 12"



"Fluid-Tite" Ends
Sizes: 3" through 12"

Outside Screw and Yoke

Conventional Packing only

Hub Ends
Sizes: 2" through 48"

Flanged Ends
Sizes: 2" through 48"

Screwed Ends
Sizes: 2" through 8"

Both Non-Rising Stem and O.S.&Y. Gate Valves may be ordered with either bevel or spur gearing. Greaae cases are available for gearing on NRS valves. By-pass Valves are furnished when specified on larger valves.

Consult your Mueller Representative or write direct for complete details.

MUELLER CO. SINCE 1857 QUALITY

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles.
In Canada: Mueller, Limited, Sarnia, Ontario

FORM NO. W-8879

PRINTED IN U.S.A.

This acetate jacket will hold Recordak copies of 28 legal-size documents or 60 letters

Best way to keep cumulative records

See how the use of Recordak Microfilming and acetate jackets trim your costs

Cuts copying costs. You can copy documents for a fraction of a cent apiece—*the lowest per-picture cost today*—with a Recordak Microfilmer that fits your requirements. All told, there are seven models designed for copying office records; *plus* three Recordak Micro-File machines for larger documents. One is just right for your needs *and budget*. Prices start at $550 when you buy . . . available on convenient monthly rental plan.

Cuts filing costs. Recordak Microfilm copies—inserted in acetate jackets—can be filed at the fingertips in a fraction of your present "paper record" space. Film copies of additional documents can be slipped into place quickly, enabling you to centralize microfilm copies by subject. You'll eliminate many familiar headaches: misfiling, soiling, tearing—to name a few. One acetate jacket like the one above (4″ x 6″) will hold 60 Recordak Microfilm copies of letter-size documents, photographed at 24 to 1 reduction ratio. Cost is approximately ½ cent per picture, including the jacket. Prices for these sturdy acetate jackets are most reasonable, vary according to sizes and quantities ordered.

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(Subsidiary of Eastman Kodak Company)

originator of modern microfilming—
now in its 30th year

"Recordak" is a trademark

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Now from FORD

New Ford C-1000 with the 260-hp. 477 Super Duty V-8 engine. Maximum GVW 31,000 lb., GCW 65,000 lb.

New Ford T-850, choice of 3 engines. Choice of 2 bogies, up to 45,000 lb. GVW and 70,000 lb. GCW.

New Ford F-1100 with the 277-hp. 534 Super Duty V-8 engine. Maximum GVW 36,000 lb., GCW 65,000 lb.

AMERICAN BUSINESS BUYS MORE FORD TRUCKS THAN ANY OTHER MAKE!

engines up to 534 cu. in...

Biggest truck engines ever built by Ford! Three all-new, Super Duty V-8's designed to stand up and deliver on America's toughest truck runs. 401-, 477- and 534-cu. in. displacements. Up to 277 hp.! Ten all-new extra heavy duty truck series rated up to 75,000 lb. GCW.

Perhaps the biggest news about Ford's all-new Super Duty V-8's is not their bigness . . . not their tremendous power output. The big story may well be in the many durability advancements, offered in the most rugged, most dependable Ford Truck engines ever built.

For instance, materials developed for the missile program are used in parts such as valve stem oil seals. Oil filters are of the same type used in commercial aircraft. The traditional exhaust-heated intake manifold is replaced by a new water-jacketed induction system. Submerged-type electric fuel pumps virtually banish vapor lock. Head gaskets are of heat-resistant stainless steel. Two compression rings and the oil control ring are chrome-plated for longer wear. A 50-amp. alternator replaces the generator as standard equipment.

These are but a few of the many advancements you'll find in Ford's thoroughly tested all-truck Super Duty V-8's for 1958. Tested in dynamometer laboratories, tested on the proving grounds, tested in commercial fleets from coast to coast . . . these new Ford V-8's, products of over six years of engineering development, are now ready to serve you.

Get in touch with your Ford Dealer for complete data on the three all-new Super Duty V-8's, and the *ten* all-new Extra Heavy Duty truck series, including tandems up to 51,000-lb. GVW, 75,000-lb. GCW, single-axle trucks up to 36,000-lb. GVW, 65,000-lb. GCW.

NEW! Three all-new engines—*401* cu. in. V-8 develops 226 hp., 350 lbs.-ft. torque . . . *477* cu. in. V-8 develops 260 hp., 430 lbs.-ft. torque . . . *534* cu. in. V-8 develops 277 hp., 490 lbs.-ft. torque.

NEW! Water-jacketed induction system contributes to maximum power output with excellent economy by providing more positive temperature control of fuel-air mixtures.

NEW! Fully machined combustion chambers and Turbulence-top pistons provide more accurate compression control and greater fuel-air turbulence, for top performance with regular grade fuel.

NEW! Submerged-type electric fuel pump virtually eliminates vapor lock. Pump delivers only solid fuel, always under pressure, operates independently of engine speed.

NEW! Valve seat inserts for intake as well as exhaust valves. Intake valves are hard-faced dished-type. Exhaust valves are sodium-cooled, faced with tungsten-cobalt.

NEW! Three-stage cooling system with separate temperature control for block and head, shortens engine warm-up time.

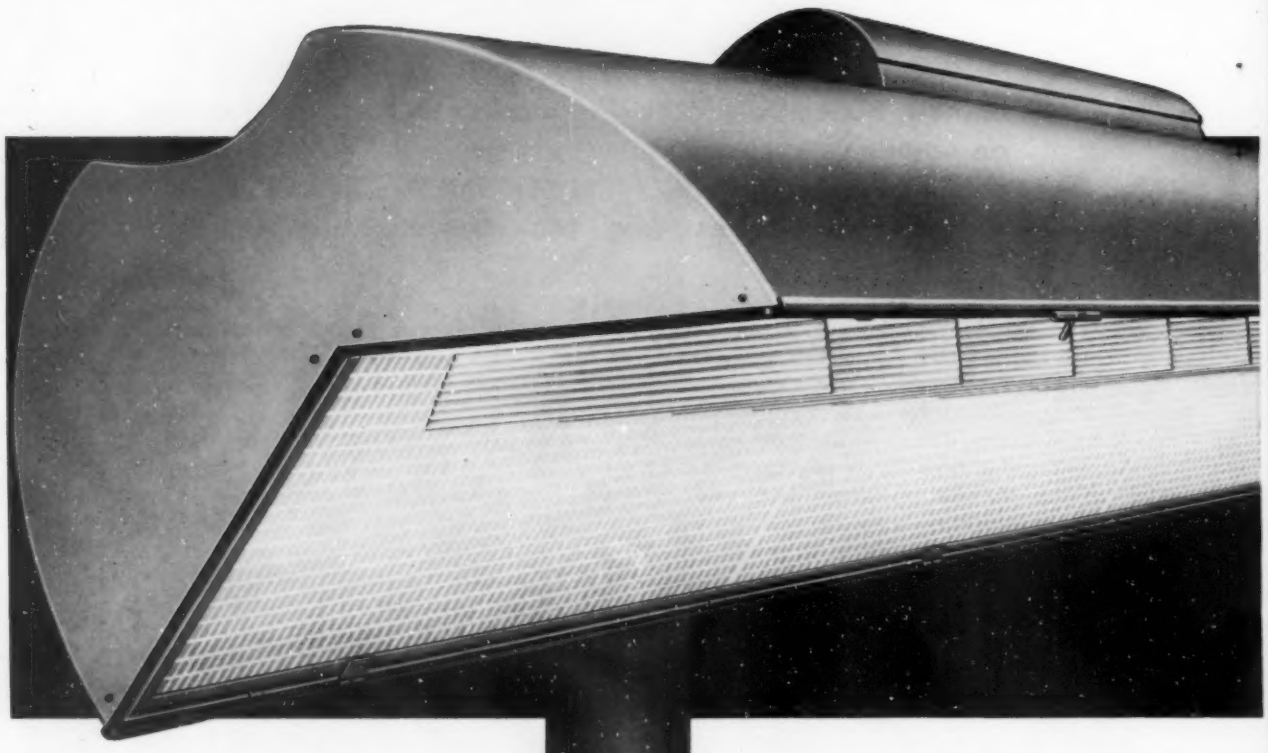
Big truck built...
Big truck powered...
At Ford's low prices!

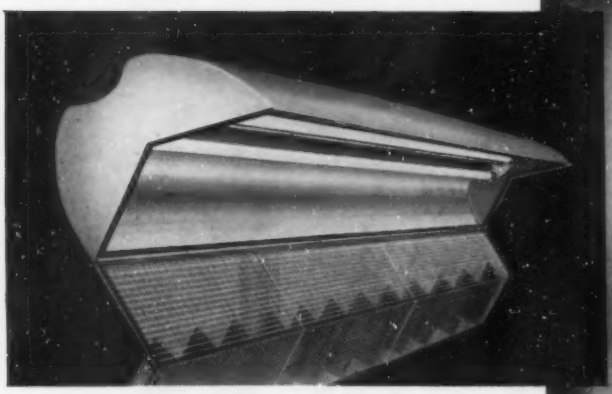
FORD TRUCKS COST LESS

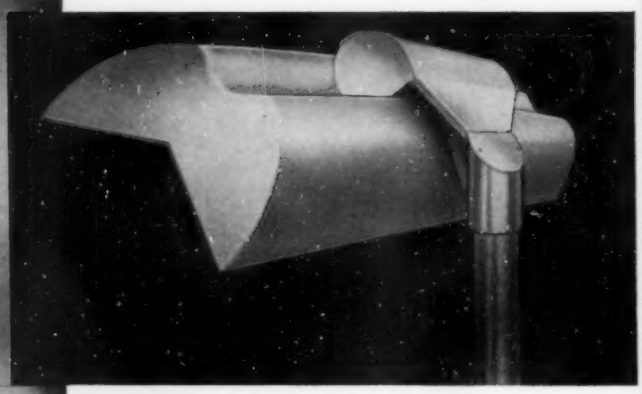
LESS TO OWN... LESS TO RUN...
LAST LONGER, TOO!

NEW MAINSTREETER

by Westinghouse







MAINSTREETER INNOVATIONS—GUIDE TO ALL FUTURE STREET-LIGHTING LUMINAIRE DESIGN:

Modern fiber-glass housing *cannot* be dented, is *corrosion-free*, never needs painting. Variety of heat-treated cast-aluminum brackets gives wide choice of mounting arrangements. Newly engineered reflectors of aluminized plastic have *exceptional* specularity! Exclusive acrylic refractor *controls* light *two* ways: interior lenses direct more than 50% greater light output onto the roadway; prismatic louvers direct light *again—further* shielding light from drivers' eyes! Sponge vinyl gasket eliminates moisture, bugs and dust; maintenance is negligible. Stainless-steel hardware retains "new" appearance. Remarkably improved ballast is easily accessible underneath "matching" cover in the support yoke, *eliminating* heat problems! "Universal" lampholders accommodate *all* rapid-start fluorescent lamps, including high-loaded lamps, giving MAINSTREETERS an almost limitless service-life! Simple switch of lamps and ballasts permits *any* circuit operation! J-04435

PARALLEL TO THE STREET! NO GLARE!

WHAT'S MORE—DELIVERS 50% MORE LIGHT TO THE ROADWAY

THAN ANY PREVIOUS FLUORESCENT LUMINAIRE!

Never before—street-lighting like this!

There is now a luminaire that provides faster, more *accurate* seeing—with *greater comfort for drivers!*—than any previous fluorescent street-lighting fixture ever developed! It is the striking new MAINSTREETER luminaire, created by Westinghouse. Moreover, MAINSTREETERS deliver efficiency of performance never achieved with fluorescent street-lighting before!

The sleek MAINSTREETER housing, of "indestructible" fiber-glass, mounts *close* to the pole and *parallel* to the street! So MAINSTREETERS avoid the cluttered daytime appearance of luminaires protruding out over the street. And the housing-ends of MAINSTREETERS—combined with special louvers on the refractor—completely shield drivers' eyes from nighttime glare of the lamps. Vision is unimpaired!

Cast-aluminum brackets provide adequate adjustment for levelling—plus the capability of tilting the luminaire for unusual applications. The entire unit is designed to give *ideal* light-distribution, conforming *exactly* to the street width!—providing *uniform* foot-candle levels—and a definition of objects impossible in the past! With less distraction and better seeing by "everyone," accident rates will be still further reduced!

In addition, new DUAL optical systems PUT OVER 50% MORE LIGHT ON THE STREET!

The *entire* output of MAINSTREETER lamps is now controlled *two* ways! MAINSTREETER refractors have, *inside*, a pattern of countless prismatic lenses—directing *more* light, from contour-engineered reflectors, *specifically* down onto the street! Then, on the *outside*, twelve exclusive prismatic louvers *again* control this light—to achieve a new concept of street-lighting comfort! The result is *better than 50% more complete utilization of all light produced by the lamps!*

See, at left, all *eight additional* features of MAINSTREETER luminaires—*already establishing* all future street-lighting design! Nothing parallels MAINSTREETERS—parallel to the street!

Watch Westinghouse Achievements in Lighting

Orders Accepted Now!

Volume production of MAINSTREETERS already is underway! Traffic engineers "everywhere" proclaim the hope of vastly improved safety records. And this is the expectation of MAINSTREETER illumination! Call your near-by Westinghouse representative for preferred delivery list information TODAY. Or, write to Westinghouse Electric Corporation, LIGHTING DIVISION, Edgewater Park, Cleveland, Ohio, RIGHT AWAY!

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7 yd struck

9.5 yd heaped

155 horsepower

5 speeds to 25.4 mph

12-ton payload

Measure these advantages for

22 hp per struck yard—Big Allis-Chalmers supercharged diesel engine delivers extra lugging ability for tough pulls, fast loading. Versatile TS-160 can team up with big equipment or work alone on long- or short-haul construction jobs—handle a wide range of utility jobs, travel at speeds up to 25.4 mph.

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Handbook on Lime Stabilization of Roads

132. This valuable handbook includes information on the types and scope of lime stabilization, evaluation of lime-soil mixes, construction methods and job descriptions and cost data. Check the reply card or write National Lime Association, Washington 5, D. C., for Handbook 323.

Complete Line of Premolded Expansion Joint Fillers

140. Expansion joint fillers for use in expansion joints in concrete are described in literature from Servicised Products Corp., 6051 West 65th St., Chicago 38, Ill. Check the reply card.

Asphalt Road Heater-Planer

186. Heater-Planer for heating and planing bituminous roads, streets, runways and parking areas is described in Bulletin FF-18 from Littleford Bros., Inc., 457 E. Pearl St., Cincinnati 2, Ohio. Check the reply card for full specifications.

Handbook on Aluminum Traffic Control Devices

60. Subjects covered in this handbook are sheet signs, extruded signs, sign posts, street signs, and complete specifications for many aluminum uses. A list of Alcoa sales offices is included. Check the handy reply card or write to Aluminum Company of America, Alcoa Building, Pittsburgh 19, Pennsylvania, for mounting, determining size of sign posts and other information today.

Beckman Industrial pH Equipment

254. An 8-page Bulletin No. 5400 gives detailed descriptions and specifications for all Beckman industrial pH instruments, electrodes and accessories. Write Beckman/Process Instruments Div., Fullerton, Calif., or check the reply card.

Highway Lighting to Prevent Nighttime Fatalities

257. A bulletin on highway lighting from General Electric, Outdoor Lighting Dept., Hendersonville, N. C., describes the lighting of the seven deadly areas and gives information on the type of lights that should be used. Check the reply card.

Improved Design of Uniflow Settling Tanks

258. A bulletin on the Uniflow settling tank for removal of solids from water, sewage and industrial waste is available from Public Relations Dept., Link-Belt Co., Prudential Plaza, Chicago 1, Ill. This bulletin is of great value to engineers who are designing settling tanks. Check the reply card.

Comprehensive Catalog on Gas Chlorinators

234. 20-page Fischer & Porter Catalog 70-15 describes features, construction and application of vacuum-type solution feed gas chlorinators suitable for manual, semi-automatic or fully automatic operation in capacities from 60 to 8,000 lbs. of chlorine per 24 hrs. Check the reply card or write Fischer & Porter Co., 560 Jacksonville Road, Hatboro, Pa., for full details.

Clow Bell-Tite Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Dorr-Oliver CompleTreator For Small Sewage Plants

266. An 8-page, 2-color bulletin that describes the Dorr-Oliver CompleTreator is available from Dorr-Oliver Inc., Barry Place, Stamford, Conn. Check the reply card for line drawings, flow diagrams and a series of photographs showing the step-by-step installation of the unit.

Designed For a New Era in Earthmoving

307. This Catalog, No. 554, describes the development of the use of 2 engines, each driving a separate axle through Torqmatic drives in earthmoving tractors. It is profusely illustrated and includes performance figures and condensed specifications. Check the reply card or write Euclid Div., General Motors Corp., Cleveland 17, O.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-⅝"x¾"-¾" and 1". Check the reply card.

How to Stop Bothersome Dust

433. A bulletin that covers the use of calcium chloride in the control of dust is available from Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich. Tables on the use of calcium chloride psy are included. Check the reply card.

Digester Mixer Uses Sludge Gas

474. Gaslifter digester circulator-mixer is described in Bulletin 25-S-91 available from Walker Process Equipment Inc, 840 N. Russel Ave., Aurora, Ill. The unit utilizes the "air-lift" principle and operates on compressed digester gas. Check the reply card for complete specifications.

Sewage-Sludge Drying Systems

484. The Standard Hersey drying system for modern, odor free sewage-sludge drying is covered in Bulletin 572 available from Standard Steel Corp., 5093 Boyle Ave., Los Angeles 58, Calif. Check the reply card for specifications, operation and installation instructions.

Practical Outdoor Lighting

489. P & K luminaires and standards for outdoor lighting provide good lighting and complement the architecture and design. Check the reply card or write Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., for models and types.

Pressure Operated Sump Controls Used in Pumping Stations

525. Literature is available from Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., describing controls used in the control of liquid level in sumps and wet wells and single and multi-pump controls for pumping stations and sewage plants. Check the reply card.

Combustion Controls and Instruments

626. This 38-page catalog covers combustion controls and instruments, switch and time delay relays, pressure indicators, pressure controls, and many other valves and regulators. Check the reply card or write General Controls, Glendale, Calif.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

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Durham, N. C., Mar. 27-28

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Pennsylvania Society of Professional Engineers Annual Convention
Reading, Pa., May 8-10

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NEW LISTINGS (Cont.)

Weeds and Brush Can Be Cleared Chemically

303. This 24-page catalog points out that various formulations of 2,4-D and 2,4,5,-T and mixtures of these chemicals now make possible year-round programs of foliage, basal and stump spraying for maximum weed and brush control. Check the reply card or write Mrs. Sharon Clayton, Organic Chemicals Div., Monsanto Chemical Co., St. Louis 24, Mo., for charts on the recommended rates of application of these chemicals.

All Welded, Field Erected Steel Storage Tanks

689. Tank sizes and tank charts for design and erection of storage tanks are fully covered in bulletin available from Fisher Tank Co., Chester, Pa. Check the reply card for information on welding, testing and maintenance of these tanks.

Most Complete Line of Portable Rotary Compressors

698. The Ingersoll-Rand Gyro-Flo is available in 6 sizes—85, 125, 210, 315, 600 and 900 cfm. Write Ingersoll Rand, 11 Broadway, New York 4, N. Y., or check the reply card for information on these advanced-design rotary compressors.

Handbook on Wheeling Corrugated Metal Culvert Pipe

701. Handbook covers the advantages, manufacture, special applications, culvert fittings and miscellaneous information on corrugated metal culvert pipe. Check the reply card or write Wheeling Corrugating Co., Wheeling, W. Va.

Waste Treatment Equipment For Municipalities and Industry

758. Bulletin No. 315-11 covers removal of solids by screening, grinding of screenings, removal of grit from waste liquids, skimming equipment and flocculation for chemical treatment. Check the reply card or write Chain Belt Co., Milwaukee 1, Wisc., for this bulletin.

New Concept in Measuring Flow Through Parshall Flumes

702. Advantages, operation, construction and special features of the Type "ML" meter for accurate measurements of flow are covered in Bulletin No. 1200 available from Burgess-Manning Co., Penn Instruments Div., 4110 Haverford Ave., Philadelphia 4, Pa. Design and capacity tables are included.

Catalog on Industrial Electronics

703. A. 358-page catalog on electronics equipment for design, manufacturing and maintenance is available from Newark Electric Co., 223 W. Madison St., Chicago 6, Ill. Check the reply card for prices on tubes, capacitors, transformers, test equipment and hundreds of specialized electronic parts.

Use The Reply Card

Keep Our Roads on the Go

761. A 52-page catalog of highway products and services that includes drainage products, bridges and bridge foundations, pavement construction products, safety equipment and highway accessories is available from United State Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa. Check the reply card.

Comprehensive Bulletin on Zeolite Water Softeners

762. Bulletin WC-108 describes Graver zeolite water softeners for municipal water plants, swimming pools and military bases. Check the reply card or write Graver Water Conditioning Co., Div. of Graver Tank & Mfg. Co., Inc., 216 E. 14th St., New York, N Y., for types of zeolites and size data.

Jeffrey Sanitary Waste Grinders

759. Literature on Jeffrey sanitary waste grinders for municipal airports is available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Types, models and schematic drawings are included. Check the reply card.

Hydraulic Highway Mowers For All Makes of Tractors

259. Mowers for roadside maintenance that are available for right, left or both side installation are described in catalog from A. C. Anderson, Inc., Wildwood, N. J. Specifications and models are fully covered. Check the reply card.

New Standard For Refuse Collection Equipment

763. Daybrook Power Packers with the force, crush and pack action are covered in catalog from Daybrook Hydraulic Div., Young Spring & Wire Corp., Bowling Green, Ohio. Check the reply card for information on these units that make more collections, more distance per route and fewer trips to the dump.

Overlaid Plywood For Highway Signs

764. Highway signs that are made of overlaid plywood that will not bend, crack or rust are described in literature from Simpson Logging Co., 2301 N. Columbia Blvd., Portland 17, Oregon. Check the reply card for data on both medium and high density plywoods.

Ford V-8 Trucks Have Electric Fuel Pumps

765. Three all-new Ford super duty V-8's, and ten all-new extra duty heavy duty truck series for maintenance and construction depts. are covered in catalog from Ford Motor Co., Truck Div., Dearborn, Mich. Check the reply card today.

Diamond Blades For Sawing Concrete

766. Felker Di-Lock diamond blades for cutting concrete pavements are described in literature available from Felker Mfg. Co., Torrance, Calif. Check the reply card.

Axles For Construction and Maintenance Trucks

767. Eaton 2-speed axles cut operating and maintenance costs in trucks. They provide easy shift, supply positive lubrication and have a self-contained air brake. Check the reply card or write Eaton Mfg. Co., Axle Div., Cleveland, Ohio.

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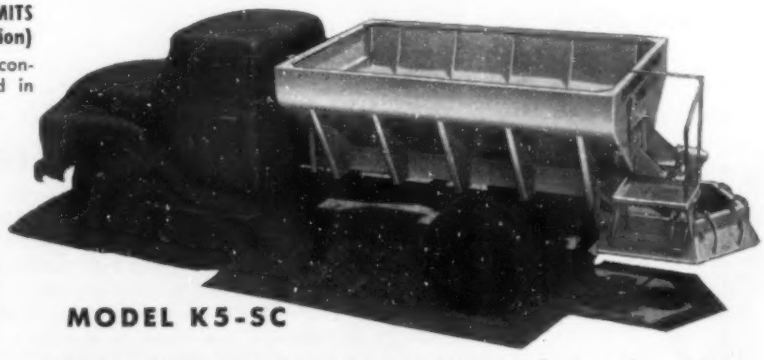

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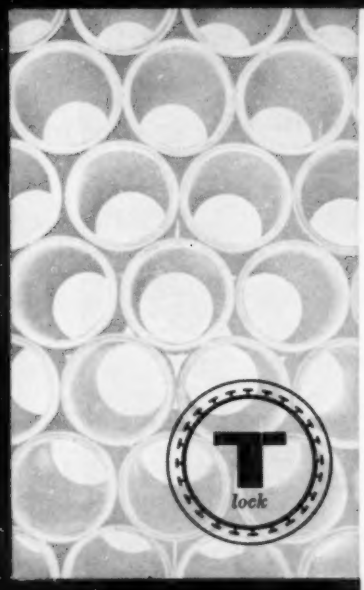

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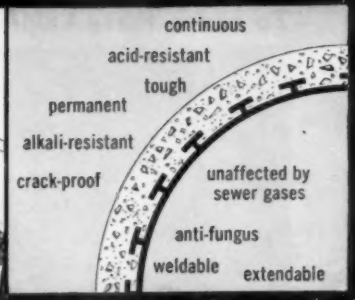

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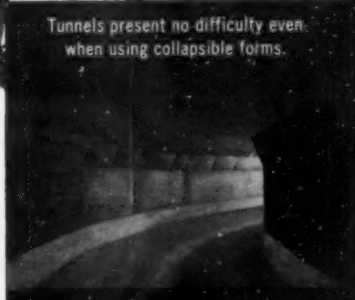

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Readily adaptable to complex forms for cast-in-place structures.

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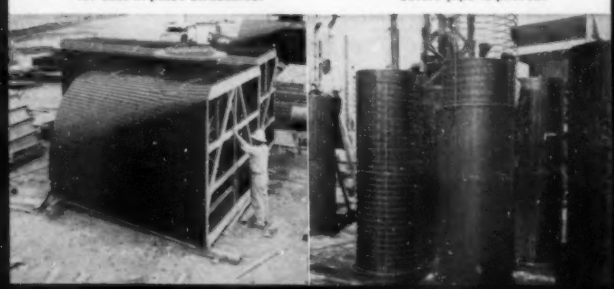

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Large diameter, chrome piston rods.
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Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Meter Features That Help Make Water Works Profitable

39. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American Water meters described in Bulletin No. 56 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Check the reply card.

Easily Cleaned Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp, Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Engineering Data on Diatomite Filters

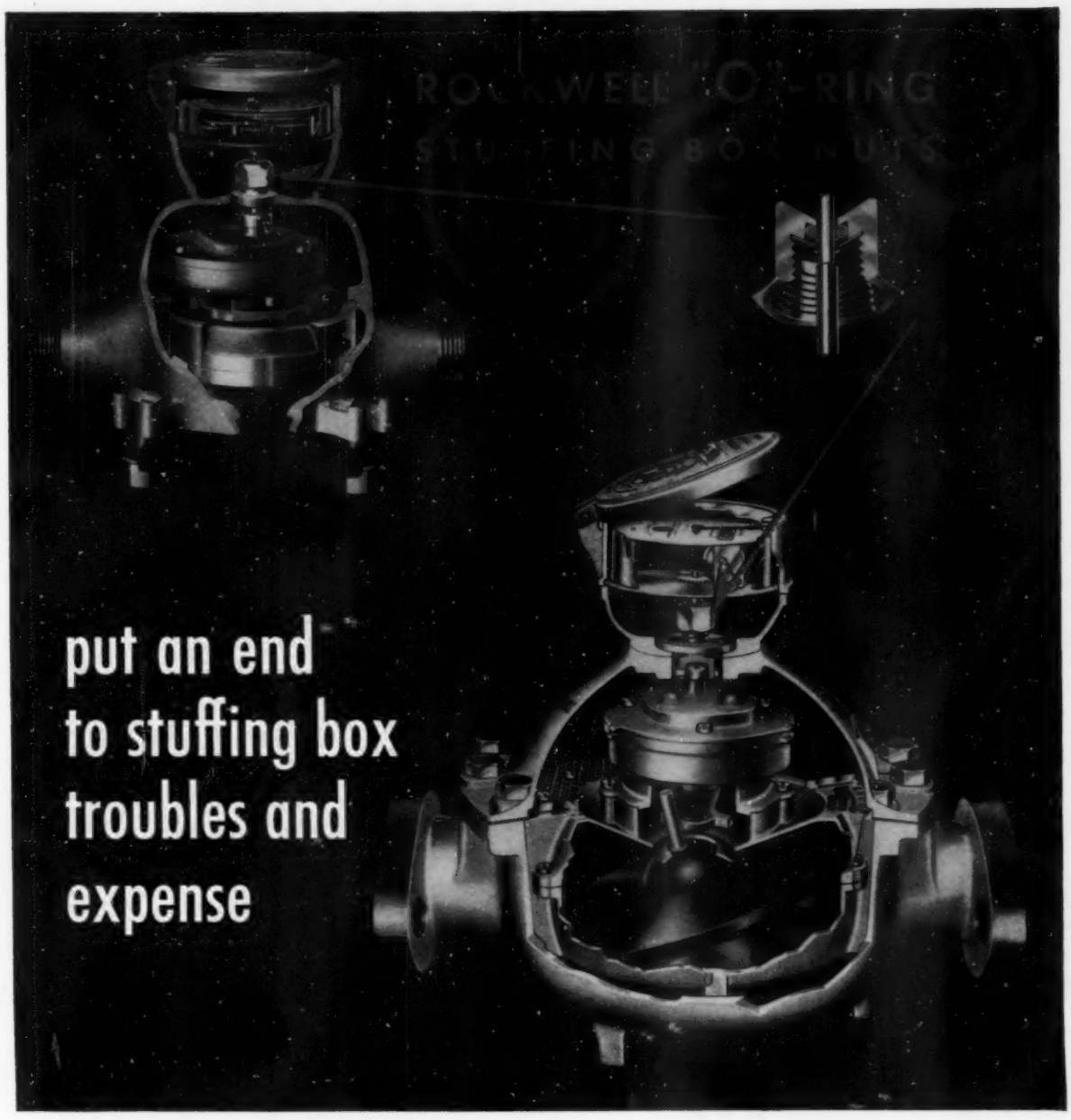
139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise"", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.



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Rockwell "O"-Ring stuffing box nuts provide a *leak tight seal* on the register drive spindle. This seal is accomplished with *very slight compression*, so friction becomes negligible and meter performance is actually improved. This construction is *foolproof*, since the "O"-Ring nut can be force tightened with a wrench without applying any additional compression.

Seven years of field experience have proved the success of this *exclusive* Rockwell development—now furnished as standard construction on Rockwell meters at no additional cost. And Rockwell "O"-Ring stuffing box nuts are available as interchangeable replacement parts for earlier model Rockwell meters. Ask your Rockwell representative to demonstrate. Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

*Patented

WATER METERS
another fine product by
ROCKWELL

To order these helpful booklets check the reply card opposite page 30.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Lay Water Mains Faster With "Fluid-Tite" Couplings

184. Get permanent water-tight joints automatically with Century "Fluid-Tite" couplings for Century asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keasbey & Mattison Co., Ambler, Penna. or by checking the reply card.

Engineering Data on Tilting Disc Check Valves

196. The Chapman tilting disc check valve is designed to lift away from the body seat without sliding or wearing; closes without slamming. Operating principles, details of construction, dimensions, recommendations and engineering data are fully covered in 18-page Bulletin No. 30. Get your copy by checking the reply card or write to Chapman Valve Mfg. Co., Indian Orchard, Mass

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Mueller Copper Water Meter Yokes

242. Copper meter yoke provides a tailor-made setting with fewer joints and fittings and it permits the installation of service lines without placing the meter. Check the reply card or write Mueller Co., Decatur, Ill., for complete information.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Catalog on Dewatering Pumps

226. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP7 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5403 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the reply card for your copy.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. PW., 227 So. Division St., Zelienople, Pa.

Quick Review of Water Meters

316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Get Bulletin W-800 by checking the reply card.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa.

Testing Water Meters

353. This 40-page catalog is a discussion of fundamentals and a guide to sound practice in meter maintenance. It covers standard specifications of meter accuracy, descriptions of the latest developments in meter testing equipment and many drawings and diagrams. For your copy write The Ford Meter Box Co., Inc., Wabash, Indiana, or check the reply card.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Check the reply card.

Welded Steel Pipe from 6 to 10 3/4" Diameter

382. High grade butt welded light-weight steel pipe from 8 to 16-gauge in 20, 30 and 40-foot lengths, plain or asphalt coated, with choice of joints. Also available up to 0.188 wall. Check uses for municipal water lines, irrigation, well casings and many other applications. Self explanatory literature from Valley Mfg. Co., Valley, Nebraska.

What You Should Know About Hypochlorination

395. "Hypochlorination of Water" is the name of an informative publication issued by Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. In it there is a discussion of chlorination theory, practice and equipment; control of algae, tastes and odors; and laboratory testing.

Control weeds and brush this low-cost way

It costs better than $100 a mile to mow a strip along highways when mowing is the only control measure. With chemical weed and brush killers, you can control growth the full width of your right of way and cut mowing costs to the bone.

But it takes some knowing to determine what to use and when to use it. And that's where DIAMOND'S experience and technical facilities can help you.

As one of the world's largest manufacturers of herbicides, DIAMOND can provide exactly right formulations to meet any requirement. Why not investigate this important new way to keep highway maintenance costs in line? Write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

Photo by The Davey Tree Expert Company

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says City Manager A. E. Axtell

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. . . CITY MANAGER A. E. AXTELL of Glenwood Springs, Colo., investigated all competing makes of tractor-shovels at job sites and demonstrations before he and the City Council were firmly convinced that "the HU 'PAYLOADER' is the best buy . . ." Operator Don Brown affirms this opinion by saying, "This (HU) is a fast, powerful loader with perfect traction on all 4 wheels . . . it has a safe, sure feel about it that lets me work fast, with confidence."

IN PERFORMANCE, the HU saves manpower and manhours for Glenwood Springs — it travels and works anywhere, truck-loads gravel, does general maintenance work on streets, roads, sidewalks and removes snow, loads out sand and cinders for ice control in Winter months.

"PAYLOADER" also provides greater usefulness than any other tractor-shovel because of the wide variety of attachments that are easily interchanged with the bucket . . . like the black-top spreader, side-boom, "4-in-1" bucket, pickup sweeper, blower, "V" and blade snow plows. One or more of these tools can be added at a fraction of the cost of special equipment. For more reasons why a "PAYLOADER" is the most useful machine your community can own, call your Hough Distributor for a Demonstration.

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Send more data on 4-wheel-drive "PAYLOADER" tractor-shovels as checked:

- ☐ **HO — 9,000 lb. carry cap. (1 to 4 cu. yd. buckets)**
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Gov't. Unit .....

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City ..... State .....

3-B-3

To order these helpful booklets check the reply card opposite page 30.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Pipe Locators and Leak Detectors

262. The new Fisher utility catalog of M-scope electronic instruments for utilities has just been released. Included are the M-scope pipe finders, two new transistorized leak detectors, a completely new line of transistorized corrosion control instruments, and water well testing equipment. Write Fisher Research Laboratory, Inc., Palo Alto, Calif.

Use The Reply Card

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Division, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin F-552 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check reply card for your copy.

Cleaning and Relining Water Pipe the Easy Way

397. Complete facilities for relining cast iron or steel water pipelines in place from 4" to 144" in diameter, with the Spunline (TM), Tate and Centriline Processes offered by Pipe Linings, 2414 E. 223rd St., Wilmington, Calif. For full information on cleaning and relining pipe with only momentary interruption of service, check the reply card.

What You Should Know About Venturi Tubes and Nozzles

400. A comprehensive bulletin, No. 100, of interest to all engineers dealing with the measurement of liquid flow and its various ramifications has been issued by Simplex Valve & Meter Company, Lancaster, Pa. Data on advantages, construction and installation details, range of sizes and specifications are given in simplified form.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

V-Notch Chlorinator For Chlorine Flow Control

502. An 8-page catalog on the W & T Series A-721 chlorinator is available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Chlorinator is adaptable to any type of chlorinator control and feed rate may be controlled manually or automatically.

3-Way Instrument Locates Underground Pipes and Leaks

540. A single instrument, the Goldak Model LC-15, provides all-around help in water system maintenance by locating pipes and valves and detecting leaks. One-man operated, accurate and dependable, this instrument is fully described in the booklet entitled "Locating Underground Pipes" and related literature. Get your copy from the Goldak Company, Inc., 1544 W. Glenoaks Blvd., Glendale 1, Calif.

"Packaged" Electric Power For Mobile Installations

656. A well-illustrated 8-page bulletin describing 3 Onan "packaged" power systems is available from D. W. Onan & Sons Inc., Minneapolis 14, Minn. Illustrated are battery charging with AC power, high battery charging output and battery charging only. Check the reply card.

Locate Water Leaks Quicker and Easier

748. An aquaphone that requires no mechanical connection between probe and diaphragm to break or cause of trouble is described fully in literature from Aqua Survey & Instrument Co., 2012 Leslie Ave., Cincinnati 12, Ohio.

Zeolite Water Softeners End Hard Water Troubles

587. A 20-page catalog on Permutit water softeners has been released by The Permutit Co., 50 West 44th St., New York 36, N. Y. Schematic diagrams, chemical reactions, operation of the water softener and specifications are some of the sections covered. Check the reply card today.

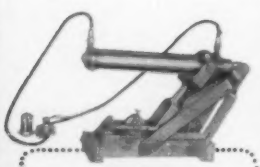
Only the
Trojan Pipe Puller & Pusher
gives you continuous action...
No Resetting of Grip!

CUTS COSTS! SAVES TIME- in installing or renewing pipe under pavement

The Trojan combines pushing and pulling operations in one machine—eliminates all time-killing resetting of grip—keeps pipe continuously moving. Does the job at lower cost—in far less time.

Model A weighs 65 lbs.—requires only 5' trench. One man can easily install the average service. 15 tons of pushing pressure possible.

Model B (either hand or air powered) needs only 5½' trench—has 3 speeds for different soils—is reversible in 30 seconds. Push pipe comes in 30" lengths, assures straight travel.



NEW AIR POWERED Model B
Does all the work for you. Handles ¾" to 2" pipe.

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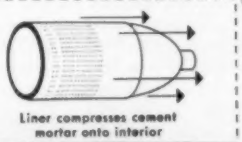

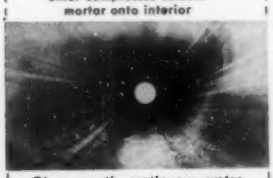

Tate Process applies cement mortar lining to the interior of 4" to 16" lines quickly and economically... while the lines stay "in place." Permanently restores full flow coefficients. Reduces pumping and maintenance costs. Protects against corrosion, contamination.

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Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered. Check the reply card.

Single Gasket Type Joint For Cast Iron Pipe

602. A double-sealing gasket type joint for cast iron pipe that is easy to assemble and install is described in catalog from American Cast Iron Pipe Co., Birmingham 2, Ala. Tables on pipe from 3" to 48" are included along with recommended deflection tables. Check the reply card.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N.J. Check the reply card and we will forward your request.

Stationary Diesels For Water and Sewage Plants

28. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 530 to 2,000 bhp and from 300 to 1,250 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #110 check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in bulletin S-55 of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif.

Efficient Material Handing to Reduce Incineration Costs

148. Blaw-Knox Buckets specially designed for refuse and garbage handling are described in 22-page Bulletin 2350-R. Illustrations show progress of material through a modern municipal incinerator plant. Dimensions and incinerator bucket specifications are included. Blaw-Knox Equipment Div., 2124 Farmers Bank Bldg., Pittsburgh 22, Pa. Check the reply card.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

Handbook on Silent Drive Chains

267. Handbook contains detailed engineering data and illustrations of silent chain drives. Check the reply card or write to Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1 Ill., for Book 2425.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

RYNAL PICK UP BROOMS
PLASTIC FILAMENT

- SWEEP CLEANER
- LOWER COST PER MILE
- MORE CONVENIENT
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RYNAL brooms *outwear natural fibres many times* . . . make available, plastic filaments, bonded in steel strips, produced by skilled craftsmen, using automatic machines.

. . . Packed in neat cardboard cartons, ready to slip into the RYNAL core. The end result is a long wearing broom, uniformly filled and well balanced.

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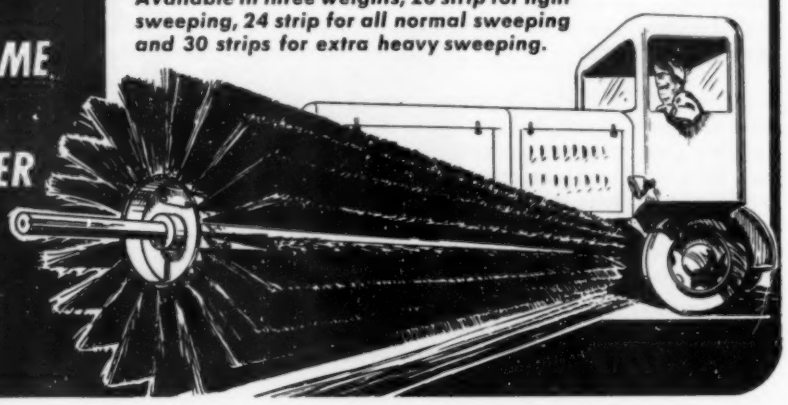
Available in three weights, 20 strip for light sweeping, 24 strip for all normal sweeping and 30 strips for extra heavy sweeping.



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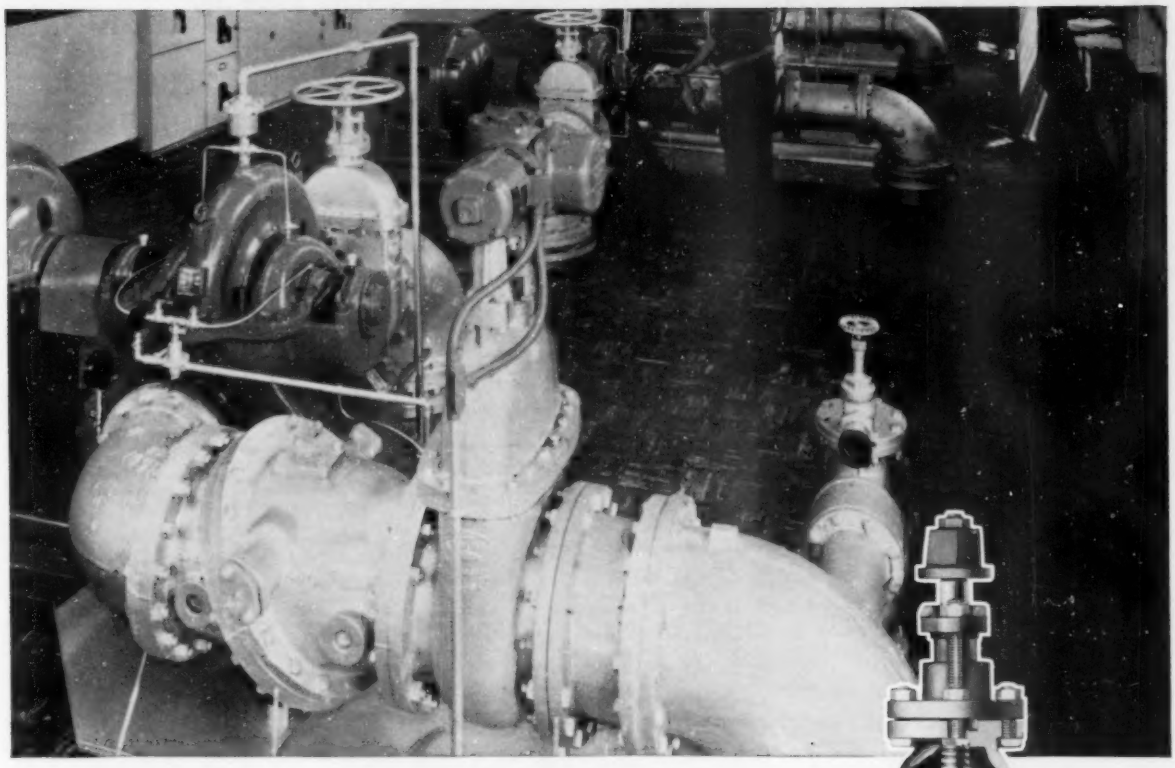


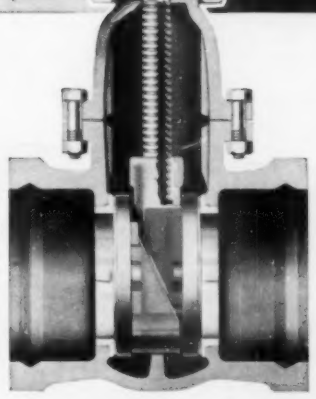
Sustained top performance

. . . a **DARLING** gate valve bonus!

HERE'S a point to bear in mind about the Darling valves installed in this fine new water pumping station at Tonawanda, N. Y. As in so many other applications everywhere, those Darling gate valves are bound to grow old, in years, but they'll *stay young* in performance!

It's the precision manufacture and the Darling fully revolving double disc parallel seat principle that always makes a world of difference! It means prolonged tight closure, avoidance of trouble and low maintenance through the years.

Look into these facts . . . and make Darling gate valves *your* first choice. They are available in types, sizes and with the proper ends for virtually all requirements. Send for Bulletin 5710.



This cutaway shows the Darling principle that assures uniform wear distribution, automatic seating compensation, prolonged tight closure and unusual valve life.

DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

DARLING VALVES

To order these helpful booklets check the reply card opposite page 30.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

Engineering Data Manual on Underground Lift Stations

218. This 100 page manual includes descriptive bulletins, specifications covering typical installations for pump type or ejector type stations, friction loss tables covering capacities and size of pipe, pump and motor selection charts and wiring diagrams. Check the reply card or write Smith & Loveless, Inc., Water and Sewage Equipment, P. O. Box 8884, Kansas City, Mo.

Modern Methods and Materials For Jointing Sewer Pipe

402. In a compilation of reprints and related supplementary material, the Atlas Mineral Products Co., Mertztown, Pa., presents a comprehensive review of all types of sewer jointing materials and methods. You will find this interesting and informative reading.

Plastic Pipe For Liquids and Gases

514. Kraloy rigid polyvinyl chloride plastic pipe can be used for liquids and gases and will not rust, rot or corrode. Write to Kraloy Plastic Pipe Co., 4720 E. Washington Blvd., Los Angeles, Calif., or check the reply card for complete details on this lightweight pipe.

Chemical to Control Sewage Odors

726. Cloroben is a sanitation chemical that provides control of sewage odors in treatment plants, septic tanks, cesspools and chemical toilets. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearney, N. J., or check the reply card for applications and performance data.

Vitrified Clay Floor System For Trickling Filters

452. The IMCO two unit floor is noted for its mechanical strength, simplicity of construction and large percentage openings for aeration. The units are self spacing and easily set in place. Check the reply card or write Industrial Materials Co., Somerset St. and Trenton Ave., Philadelphia 34, Pa., for complete catalog.

Pneumatic Ejectors—Their Operation and How to Select the One You Need

500. Comprehensive data on pneumatic ejectors is furnished in a 28-page catalog issued by the Ralph B. Carter Co., 210 Atlantic Street, Hackensack, N. J. The principle of operation, construction features, operating arrangements and controls are discussed fully. Selection charts with illustrative examples help in specifying the proper ejectors, air tanks and compressors. Complete layout dimensions and sample specifications are included. To get this valuable reference, Bulletin 5408, just check the handy reply card.

Use The Reply Card

Diaphragm & Plunger Type Dual Valve Sludge Pumps

411. A 4-page bulletin on diaphragm and plunger type dual valve sludge pumps is available from Komline-Sanderson Engineering Corp., Peapack, N J. Sludge pump is designed for feeding sewage to vacuum filter and the diaphragm pump is intended for pumping heavy slurries. Check the reply card for complete descriptions and selection charts.

Application and Design of Prefabricated Pumping Stations

637. This manual is intended for a guide in designing sewage pumping stations and in explaining the use of prefabricated underground sewage pumping stations. Check the reply card or write to Zimmer & Francescon, 1715 Fifteenth Street Place, Moline, Ill., for your copy.

CONSTRUCTION EQUIPMENT AND MATERIALS

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

How to Get Better Grader Operation

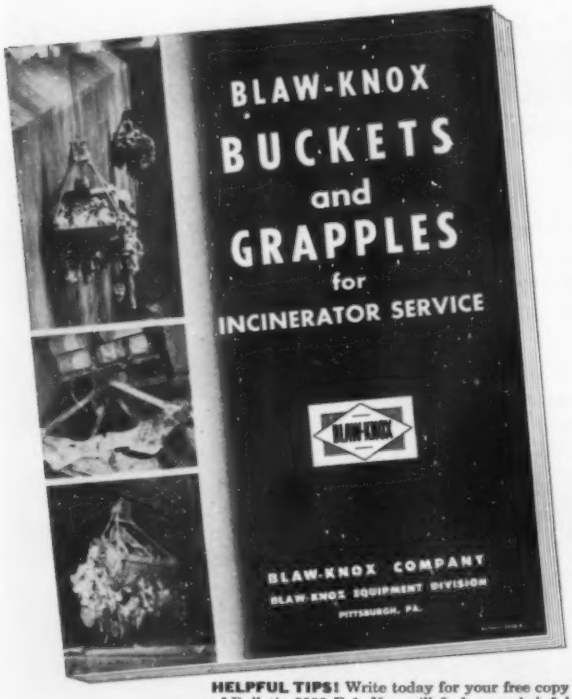
111. A most interesting and instructive 20-page illustrated action booklet on how to operate a motor grader is now available from Galion Iron Works & Mfg. Co., Galion, Ohio. Designed to help operators get more effective use from the versatile motor grader, this booklet covers the hydraulic system, steering, tips on leaning wheels, proper blade positioning, turning, gear speeds and operating procedures. Colorful, easy-to-read presentation guarantees good readership. Check the reply card for your copy.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer.

Manual on Coatings to Stop Rust

235. Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual.



HELPFUL TIPS! Write today for your free copy of Bulletin 2350 R-1. You will find many helpful answers to design and operating problems from the standpoint of efficient handling practice.

BLAW-KNOX

NEW!

for municipal and design engineers

Here is the latest information to assist you in the planning, construction and operation of modern municipal incinerators.

Blaw-Knox Bulletin 2350 R-1 offers tested, proved answers to important questions in the handling of refuse as it applies to good incinerator operating practice.

TYPICAL SPECIFICATIONS

To help guide you in selecting the proper clamshell bucket or tine-type grapple for incinerator service, Blaw-Knox Bucket Engineers have prepared typical detailed specifications.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

improving a superior product

American Concrete Cylinder Pipe has long been established as one of the outstanding developments in the field of pressure transmission of water. This superior design combines the physical properties of steel with the structural and protective properties of concrete – producing a pipe of great strength and long life. Important transmission lines of American Concrete Cylinder Pipe are today serving most of the major cities and population centers in the western United States.

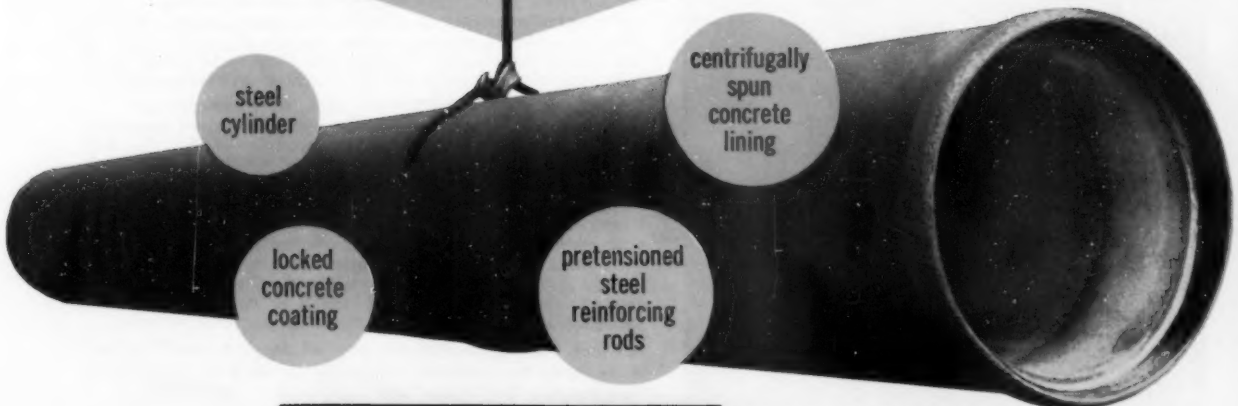
Through the years, continuing research has led to improved features in the manufacturing process. These features enrich the alkaline environment surrounding the steel components, which environment is so necessary to the continuing and everlasting protection that well-made concrete gives to this high quality pressure pipe.

Specify these plus-factors featured by American – where research, development and quality control are always striving to make high quality products even better.

American Concrete Cylinder Pipe is available in a diameter range of 12" through 60" I.D. and in standard lengths of 32 feet.

Rich cement wash applied to steel reinforcing rod just before it is wound under measured tension and with accurate spacing around concrete lined cylinder provides positive assurance of a highly alkaline environment between surfaces of cylinder and circumferential reinforcement.

An additional rich cement wash over the entire outer surface of the pretensioned steel cylinder before application of the pipe's dense mortar coating assures maximum alkaline environment where it is most needed.



American PIPE AND CONSTRUCTION CO.

Los Angeles: 4635 Firestone Blvd., South Gate, Calif., LOrain 4-2511

Hayward: P.O. Box 630—JEfferson 7-2072

San Diego: P.O. Box 13—CYpress 6-6166

Phoenix: 2025 South 7th St.—ALpine 2-1413

Portland: 518 N.E. Columbia Blvd.—BUtler 5-2531

To order these helpful booklets check the reply card opposite page 30.

Heavy-Duty Pipe Cutter Works In or Out of Trench

164. Built to stand the most severe service, the all-purpose Ellis & Ford pipe cutter, for cast iron water mains 4" through 12", is easy to use in tight places, works in or out of trench. Full details on cutter and interchangeable parts in Catalog 39, available by checking coupon. Ellis & Ford Mfg. Co., Ferndale 20, Mich.

Eaton 2-Speed Axles For Your Trucks

264. Truck axles that provide easy shift, supply positive lubrication and have a self-contained air brake are available from Eaton Mfg. Co. For complete information on these rugged axles check the reply card or write Eaton Mfg. Co., Cleveland, Ohio.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your buildings needs. In a helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co., Kansas City, Mo.

High Capacity Continuous Mix Asphalt Plants

334. A 34-page, 3-color catalog describes all of the components of Barber-Greene's Model 848 continuous-mix asphalt plant. Check the reply card or write Barber Greene Co., Aurora, Ill., for information on the mixer, several varieties of dryers, dust collectors, elevators and bins.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

International 6-Cylinder Carbureted Power Units

398. A graphically-illustrated 12-page catalog CR-511-G, on IHC 6 new 6-cylinder power units is available. Power and fuel consumption curves and cutaway views of component parts of the units are covered. Check the reply card or write Construction Equipment Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., for specifications.

Tractors and Equipment for Municipal Use

407. Specifications for the John Deere crawler and utility wheel tractors, together with equipment for loading, dozing, mowing, sweeping and many other operations is covered in a comprehensive illustrated catalog issued by John Deere, Dept. 66B, Moline, Ill. Get your copy by checking the reply card.

Keys For Master and Grandmaster Systems

573. A grandmaster-keyed installation or combined mast-keyed and keyed-alike sets are described in literature available from Master Lock Co., Milwaukee, Wisc. Steel and brass padlocks, combination padlocks and hasp lock and hasp are a few of the locks described

A Completely Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included.

Fifty Combinations of Matching Equipment For Case-Terra Trac Tractors

617. Dump loaders, angledozers, bulldozer blader, backhoes, mowers and scarifiers are several of the attachments available for the 40 to 100 hp Case-Terra Trac crawlers and industrial wheel tractors. For complete information on the attachments and tractors write J. I. Case Co., Racine, Wisc., or check the reply card.

Concrete or Asphalt Saw

458. Gasoline or electric powered Concrete Saws 1½ to 36 H.P., for low-cost cutting of green or cured concrete or asphalt are described fully in literature available from Clipper Manufacturing Company, 2800 Warwick, Kansas City 8,, Missouri. Also diamond blades for cutting cured or green concrete and 4-ply reinforced Green Con blades for lowest cost green concrete sawing are fully covered.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 108-page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill., by checking the reply card.

Power Unit By Allis-Chalmers

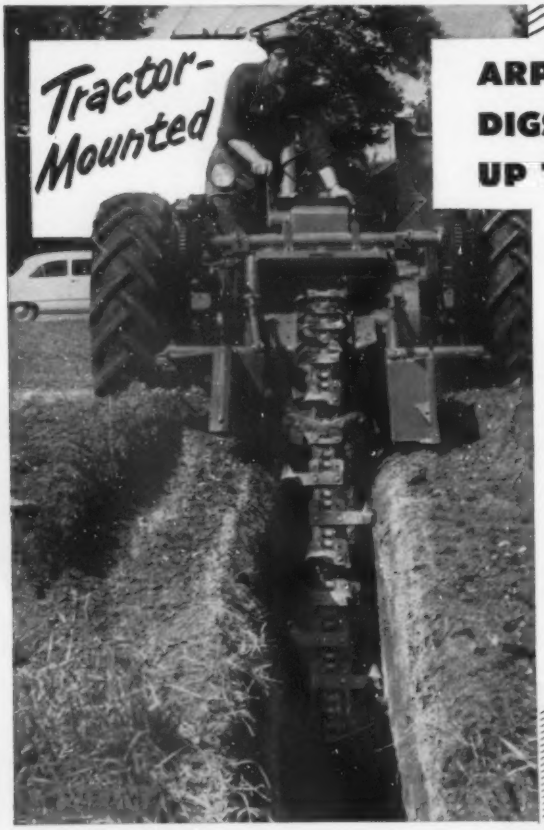
635. An 8-page, 2-color Catalog (S-1247) on the A-C B-125 power unit is available from the Tractor Group, Allis-Chalmers Mfg. Co., Milwaukee, Wisc. Various components of the unit are illustrated and specifications and a list of special equipment are included. Check the reply card.

•

BUSINESS ADMINISTRATION

System For Duplicating and Filing Engineering Drawings

754. The Recordak system for comprehensive filing of engineering drawings is described in literature available from Recordak Corp., 415 Madison Ave., New York 17, N.Y. Drawings are first microfilmed and then they are added to an aperture card for indexing.



ARPS TRENCH HOG DIGS DEEPER—7', DIGS WIDER—20", DIGS FASTER— UP TO 800' PER HOUR

HERE'S the fast, low cost way to handle most any trenching job — drainage ditches, gas lines, water mains, house service lines, septic tank laterals, foundation footings — dozens of other applications. The tractor-mounted Arps Trench Hog gives you big machine performance with a comparatively low initial investment. Has all the features to make tough jobs easy, plus the mobility only a wheel tractor can provide.

Compare the Arps Trench Hog with similar rigs — no other unit digs faster, deeper or wider. You get trenching speeds up to 800' per hour; depth capacities of 3½', 5½' and 7'; and trench widths of 6" through 20". Exclusive independent speed control for each drive wheel guarantees precise, positive control for straight line digging or curve trenching. Heavy-duty, sealed gear box keeps dust and dirt out — maintenance low. Strong, light tubular frame construction withstands the stress and impact of the toughest digging. Handy optional features include standard and tiling crumbers, one-side dirt delivery, chisel-type cutters and front-mounted angle-dozer for fast backfilling.

See how the Trench Hog can pay off on your trenching jobs. Write today for complete information to the Arps Corporation, New Holstein, Wis., Dept. PW

ARPS CORPORATION New Holstein, Wis.

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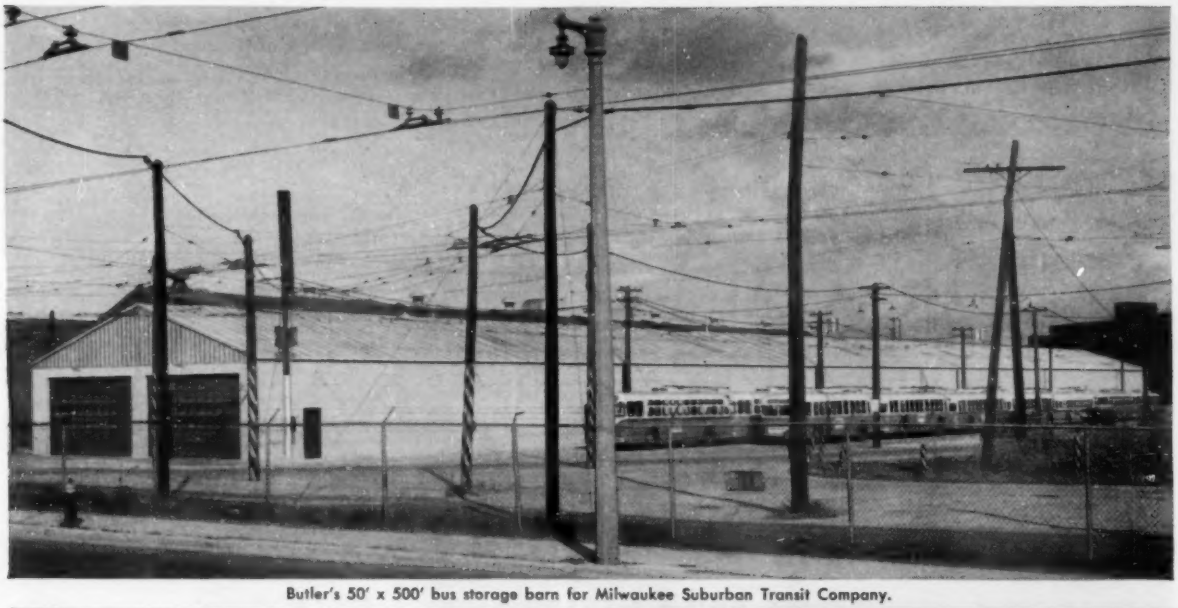
BULL-DOZERS • UTILITY BLADES



Butler's 50' x 500' bus storage barn for Milwaukee Suburban Transit Company.

Butler storage-service barn for Sioux Falls Transit, Inc., Sioux Falls.

Interior Sioux Falls Transit shows storage and maintenance facilities.

Must county and state garaging be expensive to be good?

Not necessarily. Many county and state officials now build garage and maintenance facilities (other public works buildings, too), that are not only a credit to their administrations, but well within limited budgets, as well.

Their lower-cost method is no state secret. It is the Butler Building System—a superior construction method that industry has used for years to hold building costs down.

The buildings pictured above in Milwaukee and Sioux Falls, are typical examples. A look at the interior shows you how economical, pre-engineered Butler structurals form a basic, load-bearing frame that is enclosed with any curtain wall material you specify. You get quickly-erected, fire-safe, self-ventilating buildings that are easy to heat and light.

Consider Butler for your construction needs. Here is a way to get outstanding, quality buildings with clear-span interiors up to 120 feet wide, for usually far below traditional construction estimates.

Your Butler Builder listed under "Buildings" or "Steel Buildings" in the Yellow Pages of your phone book, has all the details. Ask for our free booklet, "The Community Decides To Build." Or, write us direct.

see our catalog in Sweet's or write for copy

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To order these helpful booklets check the reply card opposite page 30.

STREETS AND HIGHWAYS

How to Prepare and Maintain Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

How Accurate Boring Speeds Underground Pipe Installations

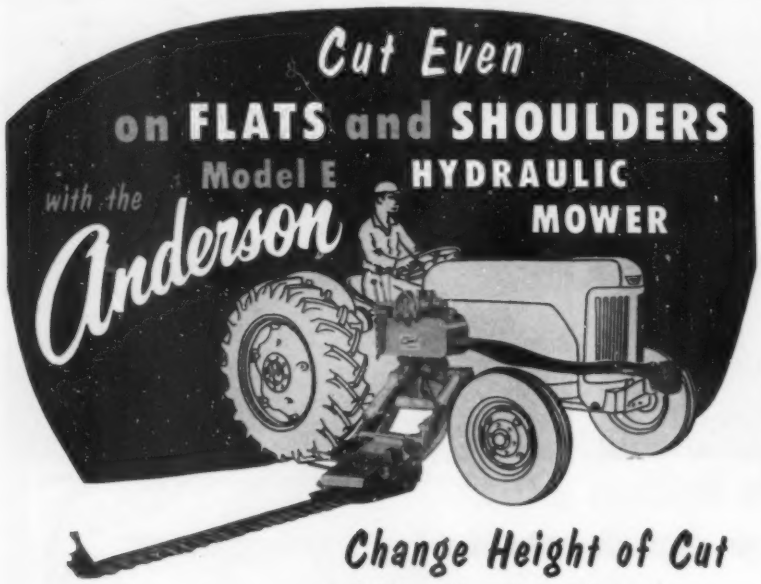
135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Better Highways Through Salt-Soil Stabilization

162. Practical information for the men who build, repair and maintain our highways is provided in two bulletins issued by the International Salt Co., Inc., Scranton, Pa. General principles of salt-soil stabilization, applications, plant mix and road mix are described. Check the reply card for your copies.

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.



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With the Anderson's exclusive cutter bar parallel lift, cutting height can be adjusted instantly from ground level to 18" without interfering with mowing. This is made possible by the Anderson system of parallel mounting and unique cylinder action which assures level rise of both inner and outer shoes. The Anderson hydraulic cylinder action also enables the cutter bar to be raised to vertical position to avoid obstacles and then returned to horizontal at the set cutting height with a single control.

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Call Your Anderson Dealer, Today!

HYDRAULIC MOWERS • HYDRAULIC LOADERS • BULL DOZERS

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

Valuable Information on Concrete Testers

210. Concrete compression testers and flexure testing machines, portable concrete testers, and testing machines for concrete, clay and tile pipe are described fully in Bulletins from Forney's Inc., Tester Div., P. O. Box 310, New Castle, Pa. Check the reply card for complete information on models and specifications.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

Davis Back-Hoe and Davis Loader

312. Literature is available from Massey-Ferguson Industrial Division, Massey-Harris-Ferguson, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

Tractor-Shovels With Drott "Four-In-One" Attachment

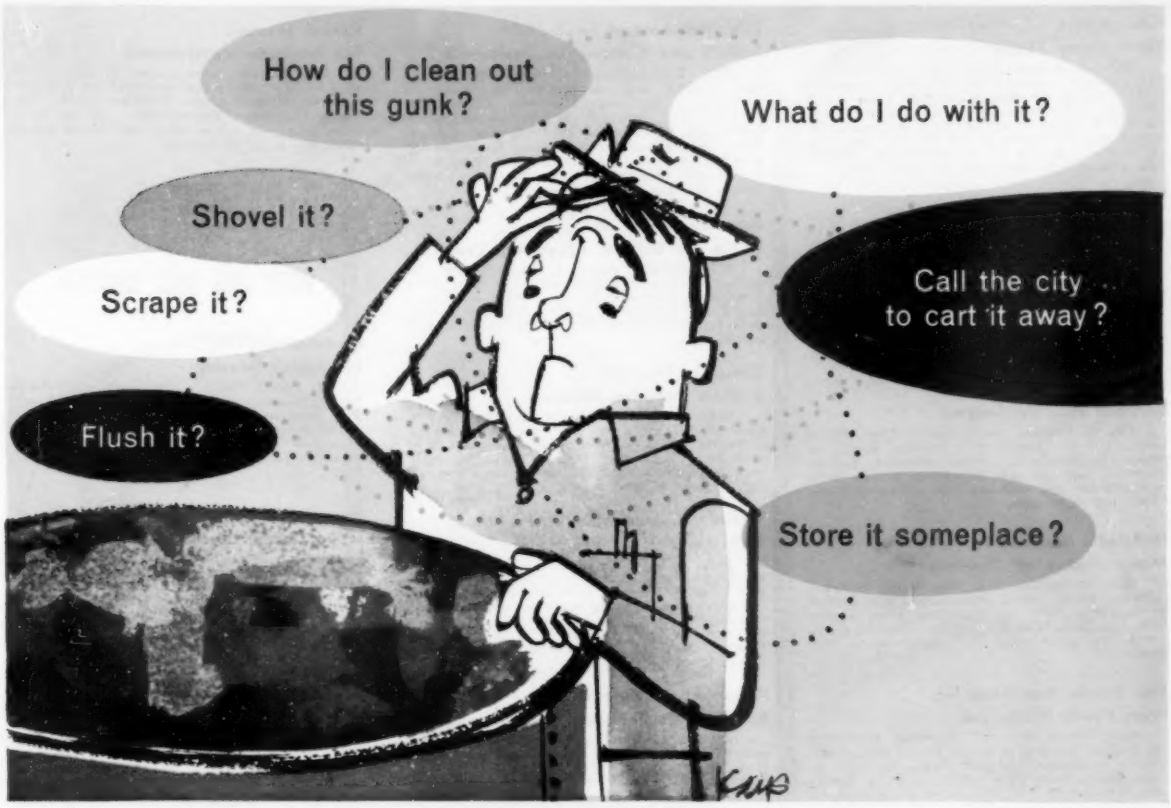
332. Hough rubber-tired front-end loaders come equipped with the Drott "4-in-1" bucket. Check the reply card or write The Frank G. Hough Co., Libertyville, Ill., for literature on how to use this unit as a shovel, clamshell, scraper and bulldozer.

Catalog on Utility Bodies and Equipment

360. General service bodies, line construction bodies, aerial equipment, winch and derrick equipment and trailers are the units covered in this catalog. For design, dimensions, illustrations and descriptions check the reply card or write McCabe-Powers Auto Body Co., 5900 N. Broadway, St. Louis 15, Mo.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Lube Jack Co., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included. Check the reply card.



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Yes, we mean never! You prevent costly shutdowns for maintenance. You save time and completely eliminate labor costs for cleaning out brine tanks. For Morton Purex Salt is 100% soluble. It will leave no accumulation of sludge—shale and sulphates—in either your brine or water-softening system.

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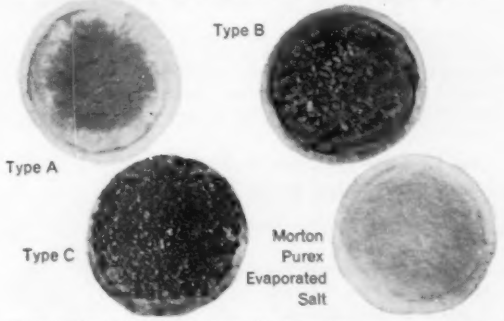
With sludge-free Morton Purex Salt, you get high-purity evaporated salt made in a controlled-particle size to prevent packing and channeling. Purex can be used in bulk wet storage systems and in the Morton Model E Brinemaker.

These filter pads (approximately 1/6 actual size) show you how much insoluble matter (sludge) you get in just 5 lbs. of various types of salt



Tests for insolubles taken from these random samples show you that Morton Purex is the only one that contains no wasteful sludge or insolubles.

For more information about Morton Purex Salt and for free, expert help on any water-softening or brine-making problem, write or wire:

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Dept. PW-3-58, 120 So. LaSalle Street,
Chicago 3, Illinois

To order these helpful booklets check the reply card opposite page 30.

New Acker Vane Shear Tester

367. A bulletin describing a new inexpensive accurate technique for obtaining "in-place" shear readings of soils is available from Acker Drill Co., Inc., Scranton 3, Pa. The shear test kit has a complete set of vane test tools for testing soils to depths of 100 ft., and operating information on this kit is covered in Bulletin 700, available by checking the reply card.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave. S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

Plastic Filament Street Sweeper Pick-Up Brooms

436. Literature is available from Rynal Corp., 114 St. Joseph St., Arcadia, Calif., on plastic filaments for street sweeper pick-up brooms. They are easy to replace, storage space is eliminated and moisture will not attack them. Check the reply card.

Hydraulic Backhoe For Many Makes of Tractors

456. A backhoe that digs sewer systems, culverts, water mains, foundations and ditches is described fully in literature from Henry Mfg. Co., Inc., 1700 N. Clay St., Topeka, Kans. Check the reply card for specifications and details.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Complete Line of Road Rollers and Compaction Equipment

520. Buffalo-Springfield's complete line of road rollers and compaction equipment is described in a 12-page illustrated Buletin No. S-73-157 just released by Buffalo-Springfield Roller Co., Division of Koehring Co., Springfield, Ohio. Check the reply card for on-the-job pictures, as well as construction details of the 2-axle tandems, 3-axle tandem, 3-wheel rollers and the K-45 Kompactor.

Detailed Data and Prices on Optical Repeating Transits

583. Optical repeating transits are described fully in literature available from Wild Heerbrugg Instruments, Inc., Main at Covert St., Port Washington, N. Y. Check the reply card for information on design, operation and prices.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y., or can be obtained by checking the reply card.

Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 120 So. LaSalle St., Chicago 3, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

Rotary Mowers For Roadside Maintenance

622. Rotary mowers that fit most makes of 4-wheel tractors are described in literature available from Danuser Machine Works Inc., Tulsa, Oklahoma. For complete information on these units for grass, weed and brush control check the reply card today.

●

WEED AND DUST CONTROL

Investigate "Tifa" For Insect Control

47. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use reply card for full data on public health programs. Products Div., Todd Shipyards Corp., Columbia & Halleck Sts., Brooklyn 31, N. Y., Greens Bayou, Houston 15, Texas.

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

Manual For the Pest Control Operator

592. This manual contains technical data and complete information about Geigy Diazinon, a long residual organic phosphorous compound for pest and insect control. For full data check the reply card or write Geigy Agricultural Chemicals, Saw Mill River Road, Ardsley, N. Y.

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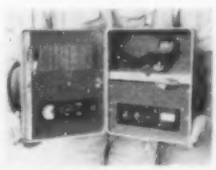

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In Canada: The Union Metal Manufacturing Company of Canada, Limited, Brampton, Ontario.

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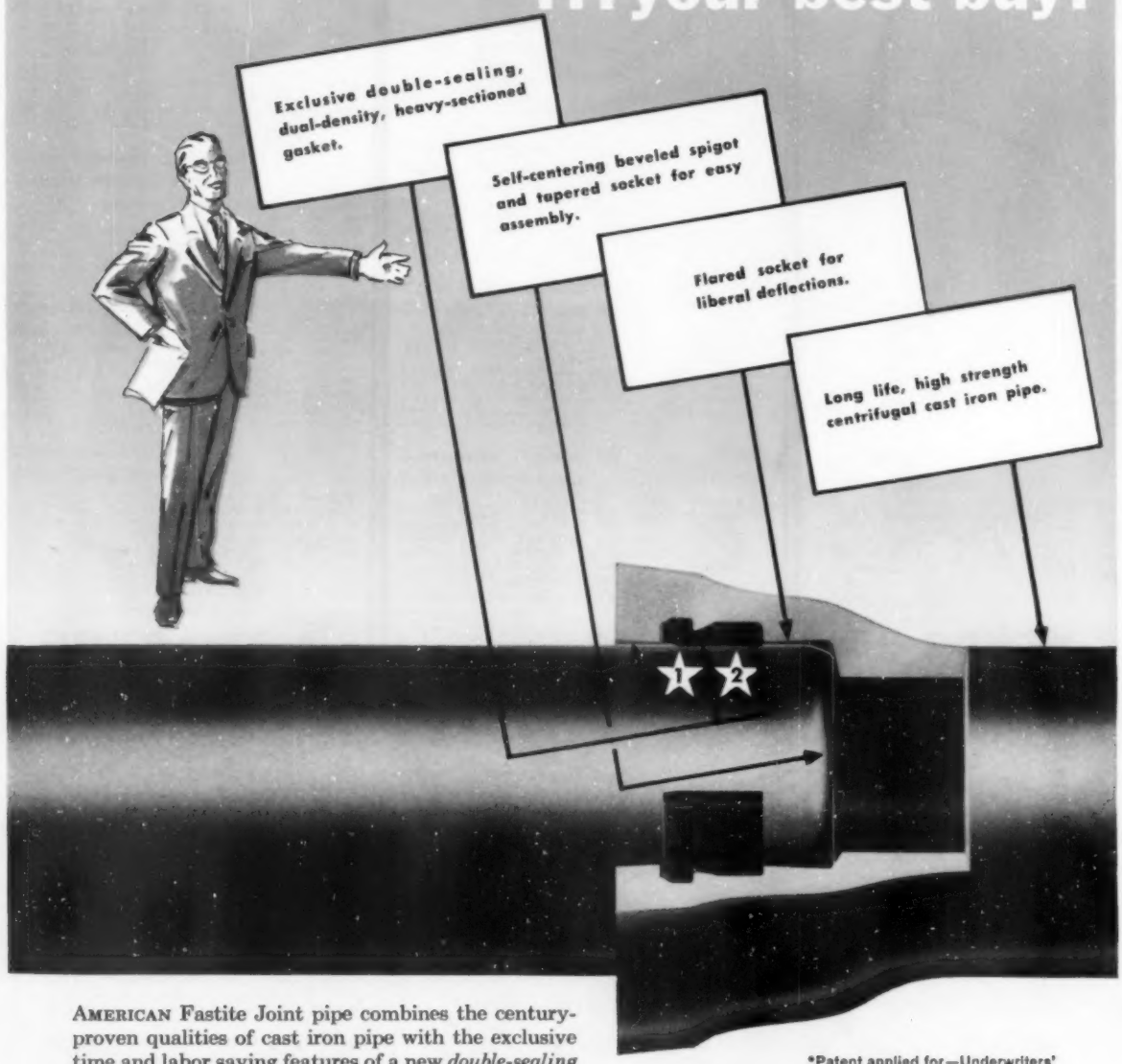
AMERICAN *Fastite*** Joint* Pipe ...your best buy!


Exclusive double-sealing, dual-density, heavy-sectioned gasket.
Self-centering beveled spigot and tapered socket for easy assembly.
Flared socket for liberal deflections.
Long life, high strength centrifugal cast iron pipe.
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BIRMINGHAM 2, ALABAMA

To order these helpful booklets check the reply card opposite page 30.

REFUSE COLLECTION AND DISPOSAL

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Refuse and Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

Complete Package Dravo Incinerator Plant

584. The Dravo incinerator includes receiving pits, automatic refuse handling system, automatic combustion controls, traveling grate stoker and everything necessary for the efficient operation of the plant with minimum personnel. Write for full information to Dravo Corp., Dravo Building, Pittsburgh 22, Pa., or check the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

Valuable New Floodlighting Catalog

403. A 16-page catalog containing information on tapered steel and aluminum Monotube floodlighting poles designed for use in lighting outdoor sports activities, commercial and industrial areas and parking lots, has just been issued by the Union Metal Mfg. Co., Canton 5, Ohio. Easy-to-read diagrams, illustrations and applications are included. Check the reply card.

A Guide to Effective Traffic Safety

468. A 20-page catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestrian traffic areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs.

Engineering Guide on Mercury Street Lighting

640. Technical data on mercury lamps applicable to general lighting service, operating characteristics of the mercury vapor lighting system and economic evaluation of lighting systems designed for equal lighting results are several of the sections covered in catalog from Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, Ohio

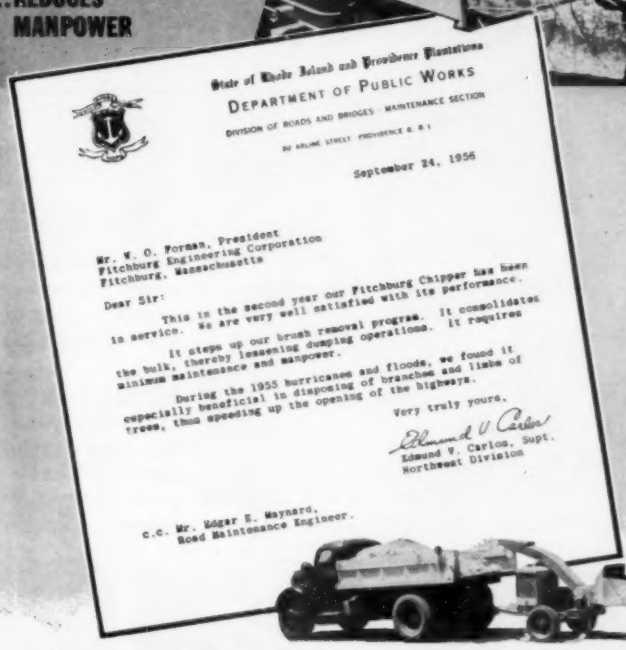
SNOW AND ICE CONTROL

Spreading Equipment For Ice Control

543. An ice control catalog describing the full line of Baughman ice control spreading equipment has been released by Baughman Mfg. Co., Jerseyville, Ill. Included are illustrations and descriptions of truck-mounted spreader bodies, tail gate spreaders, dump body and pull type spreaders and gravity feed spreaders. For your copy of this helpful and interesting booklet check the reply card today.

FITCHBURG CHIPPER STEPS UP
Rhode Island Brush Removal

...CONSOLIDATES THE BULK
...LESSENS DUMPING OPERATIONS
...REQUIRES MINIMUM MAINTENANCE
...REDUCES MANPOWER



State of Rhode Island and Providence Plantations
DEPARTMENT OF PUBLIC WORKS
DIVISION OF ROADS AND BRIDGES - MAINTENANCE SECTION
80 ARLINE STREET, PROVIDENCE 6, R.I.

September 24, 1956

Mr. W. O. Forman, President
Fitchburg Engineering Corporation
Fitchburg, Massachusetts

Dear Sir:

This is the second year our Fitchburg Chipper has been in service. We are very well satisfied with its performance.

It steps up our brush removal program. It consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower.

During the 1955 hurricanes and floods, we found it especially beneficial in disposing of branches and limbs of trees, thus speeding up the opening of the highways.

Very truly yours,

Edmund V. Carlos

Edmund V. Carlos, Supt.
Northeast Division

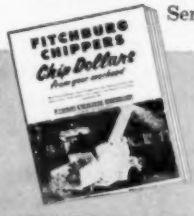
c.c. Mr. Edgar E. Maynard,
Road Maintenance Engineer.

Brush disposal cost can be reduced.

Your City will find that the Fitchburg Wood Chipper is money-saving equipment in your Highway or Park Departments. Tree trimmings are quickly reduced into load-saving wood chips. Fewer loads cuts your loading and hauling expenses. Brush removal becomes a faster, simpler, less expensive operation.

Fitchburg Wood Chippers are engineered to stand hard use, to give long service without excessive maintenance costs. There is only one Wood Chipper on the market today with a One Year Guarantee...The Fitchburg Wood Chipper.

Send for a copy of "Chip Dollars From Your Overhead."



NEW FREE BOOK
"Chip Dollars From Your Overhead"
Complete with cutaway color drawings of Chipper in action. Specifications, etc.

FITCHBURG ENGINEERING CORPORATION
Fitchburg, Massachusetts, Dept. PW-38

Send my free copy of "Chip Dollars From Your Overhead" to:

Name _____

_____
(Position or Company)

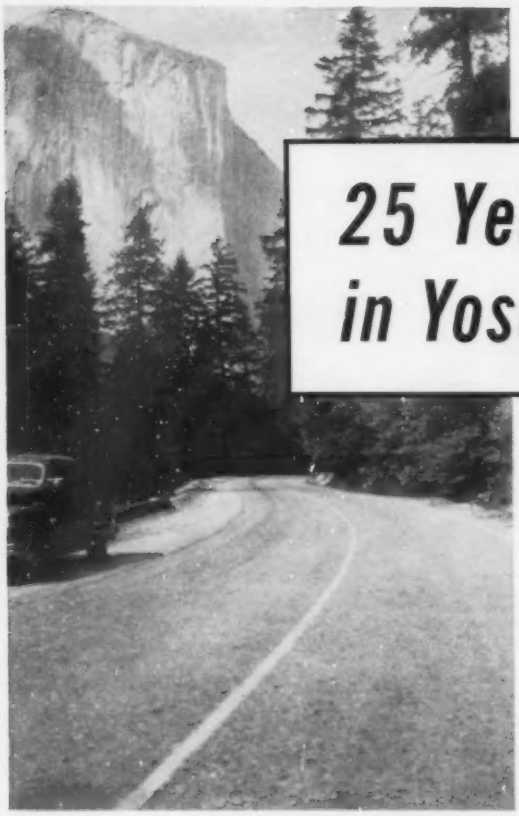
Address _____

City _____ State _____

FITCHBURG ENGINEERING CORPORATION
FITCHBURG, MASSACHUSETTS

BITUMULS SURFACE TREATMENTS ARE REAL LIFE SAVERS*

25 Years of Good Roads in Yosemite National Park



1933: Heavy-duty pavements of Bitumuls Penetration Macadam.

* By permission of Beech-Nut Life Savers, Inc., for candies

Just over 25 years ago, engineers of Yosemite National Park prepared for an expanded program of road surfacing. Located far from any hot-mix plants, they specified the then-new Bitumuls® Penetration Macadam type of construction.

This sound pavement provided excellent service, even in areas where snow, ice, and rigorous weather prevail for many months of the year. These roads in Yosemite are now open the year-around for winter sports enthusiasts.

With the improved road system, visitors came to the Park by hundreds of thousands. As a result of this heavier-than-anticipated traffic, combined with the severe weather, the need for an organized maintenance program became obvious. That's when the Park Engineers turned to Bitumuls Surface Treatment as a proved "life saving" maintenance tool.

1948: For 15 years, occasional Bitumuls Surface Treatments have kept pavements in top shape.

1957: Newly-introduced Bitumuls Slurry Seal also used for road and walk maintenance.

Bitumuls Surface Treatments not only successfully extended the life of the pavements, but also provided all-year, skid-proof, safe surfaces.

In 1957, Park officials employed another American Bitumuls development known as "Bitumuls Slurry Seal." This new technique is a very economical "life saver." It performs a "holding action" against weathering and further deterioration, permitting continued use of the pavement ahead of planned resurfacing.

American Bitumuls & Asphalt Company

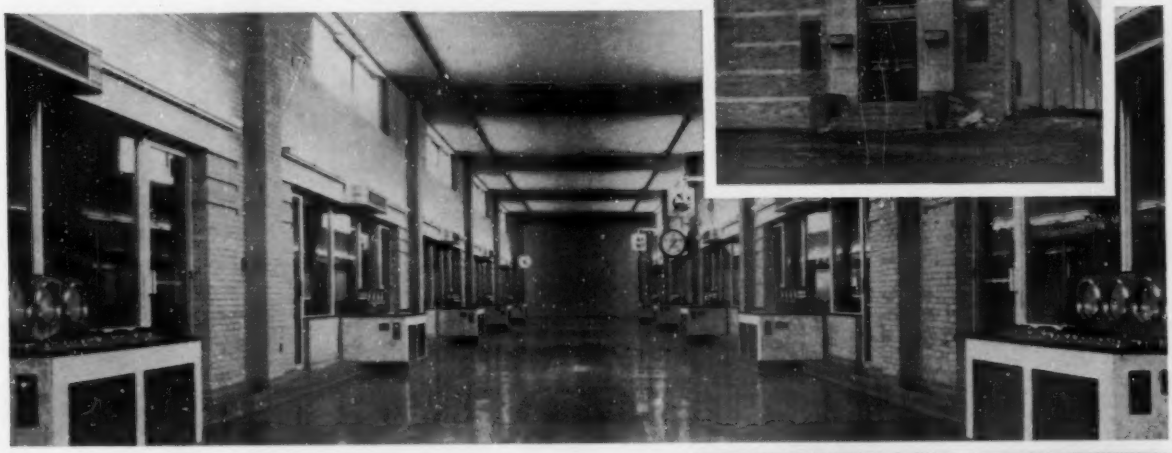
320 Market St., San Francisco 20, California

Baltimore 3, Md. · Mobile, Ala. · Inglewood, Calif. · St. Louis 17, Mo. · San Juan 23, P. R. · Oakland 1, Calif. · Perth Amboy, N. J. · Cincinnati 38, Ohio · Tucson, Ariz. · Portland 8, Ore.

Call our nearest Bitumuls office for details on these paving and maintenance techniques, and for the "Bitumuls/Life Saver" story.

For new 40 mgd addition to
Toledo's Collins Park Filtration Plant...

CONS. ENG.—Finkbeiner, Pettis & Strout; COMM. WATER—Sol J. Wittenberg
CHIEF ENG. DIV.—George Van Dorp



34 years' accurate control makes it 100% Simplex again!

34 years of accuracy. No troubles. That's the service record of Simplex filter controllers, venturi tubes and meters at Toledo.

Dependable accuracy like this is essential to your plant, too. So take a closer look at Toledo's experience with Simplex:

1921 – 34 Simplex Controllers installed.

1929 – 22 Simplex Controllers added. (All 56 coordinated with Simplex Master Control System, including Gauges & Meters.)

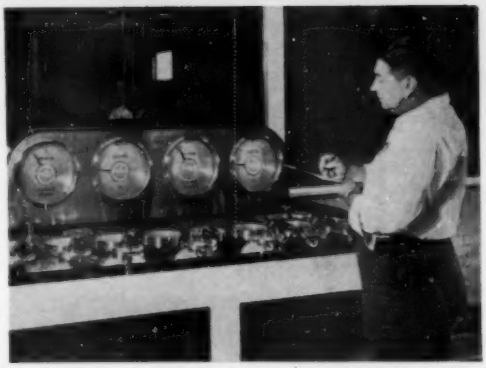
1941 – New Collins Park Plant selects: 40 Simplex Rate Controllers. (Also Simplex W. W. controllers; 60" Venturi Tubes & Meters; plus Gauges & Meters.)

And again in 1956 for Toledo's expansion to 120 mgd—it's 100% Simplex with integrated Pneumatic Master Control. Equipment chosen: 20 Rate Controllers; 60" Venturi Tubes and Meters; Gauges; Wash Water Controllers.

Efficient performance – with minimum maintenance – saves money throughout the years. That's why it's wisest for budget-conscious communities to start with the best.

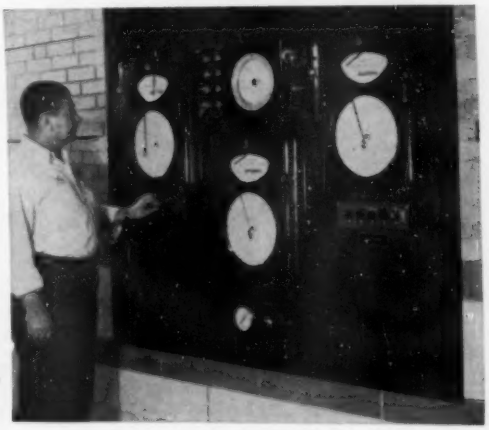
Write for Technical Bulletins – Simplex Valve & Meter Co., Dept. PW-3, 7 E. Orange St., Lancaster, Pa.

SIMPLEX®
VALVE AND METER COMPANY
VENTURI TUBES • FLUMES • METERS • GAUGES
TRANSMITTERS • CONTROLLERS • TABLES • AIR VALVES



Compact group of easy-to-read Simplex gauges indicates rate and head loss for a pair of the 20 new 4-mgd each filter units

Part of the Simplex Pneumatic Master Control System that permits varying the rate of ten new filters from one location. This panel indicates, summates and records flow of raw, wash and filtered water



what's it worth to dig in close quarters

DAVIS LOADER-BACKHOE

will get you out of a pinch!

CLOSE-IN DESIGN OF DAVIS LOADER — Provides excellent visibility. It packs the power to take big bites. Sturdy box-frame arms have long reach for discharging loads into fill holes, piles, or high-bed trucks. No wonder, Davis is the one others follow.

FIVE-MINUTE DETACHABILITY — Entire Davis Backhoe can be detached in five minutes if you want to use just your tractor for other jobs. Stabilizer feet and boom form tripod so unit is ready for immediate re-attaching.

The exclusive features, superior maneuverability, and wide-range visibility of Davis rigs let you operate under "pinched" conditions impossible for other rigs... increase your profit potential by eliminating expensive hand digging!

Visibility to Operate in Tight Quarters — Davis works best in close quarters because you don't have to "feel" your way. Low Loader silhouette, location of seat provides excellent view of where you are working.

Sets Up in Places Inaccessible for Other Machines — Exclusive flush digging and continuous 200° operating arc of the Davis 210 Backhoe lets you operate efficiently in places where you would otherwise have to use expensive hand labor. No other machine could work there.

Alert Controls Permit Precision Operations — Independent controls are mounted in convenient fingertip locations that allow you to always face the job. They respond lightning-fast to your command.

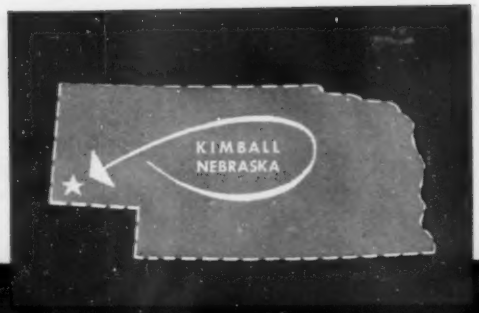
Davis Loaders and Backhoes are available for all popular models of International, Ford, Fordson Major, Ferguson, Case, Massey-Harris, Allis-Chalmers, Oliver, John Deere, Minneapolis-Moline, and Work Bull Tractors.

SOLD AND SERVICED EVERYWHERE BY BETTER DEALERS

For the name of your nearest dealers call Western Union by number and ask for Operator 25... or write direct. Please specify make of tractor.

MASSEY-FERGUSON INDUSTRIAL DIVISION
MASSEY-HARRIS-FERGUSON, INC.
1009 S. WEST STREET • WICHITA 13N, KANSAS

Kimball's power plant saves $58,000 yearly!



powered by . . .

SUPERIOR DUAL-FUEL ENGINES

Six years ago, fast-growing Kimball, Nebraska decided to modernize its inadequate power plant. Today, powered by three Superior Dual-Fuel Engines, Kimball's power plant is saving $58,000 a year over private utility rates. The engines operate with natural gas at an average cost of 6.93 mills per KWH. On diesel fuel alone power costs are 10 mills per KWH, and annual savings would be $35,000.

The first engine paid for itself in savings in less than three years! Repeat orders later demonstrated the confidence of Kimball city fathers in Superior engine quality. As a further bonus, the three engines are expected to give good service for 35 to 40 years, according to the town's Public Works Director.

Such *savings, satisfaction* and long-term *service* are characteristic of White's Superior engines. See how you can participate in "Kimball-type" savings. Call or write the nearest office listed below. Let White's engineers discuss the new features of Superior and Atlas engines, ranging from 100 to 2150 H.P., for power to 1500 KW.

White Diesel

WHITE DIESEL ENGINE DIVISION

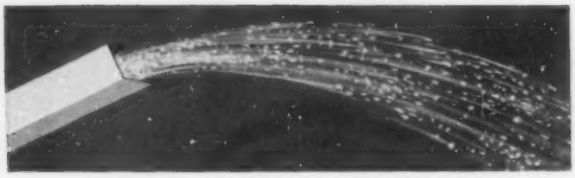
THE WHITE MOTOR COMPANY Plant and General Offices: Springfield, Ohio

SALES AND SERVICE POINTS: Ketchikan, Alaska • San Francisco, Terminal Island, California • Denver, Colorado • Washington, D. C. • Clearwater, Florida • New Orleans, Louisiana • Boston, Mass. • Park Rapids, Minnesota • Webster Groves, Missouri • Calloway, Nebraska • New York, New York • Portland, Astoria, Oregon • Ft. Worth, Houston, Texas Seattle, Wash. • Halifax, Nova Scotia • Vancouver, B. C.

IT'S AN ECONOMIC FACT

You can chip more brush

faster



at less cost

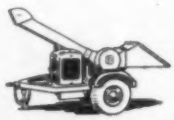
with an ASPLUNDH CHIPPER

than with any other machine on the market today!

Asplundh Chippers can cut your hauling cost 75%, completely eliminate brush burning, and provide a useful, valuable by-product.

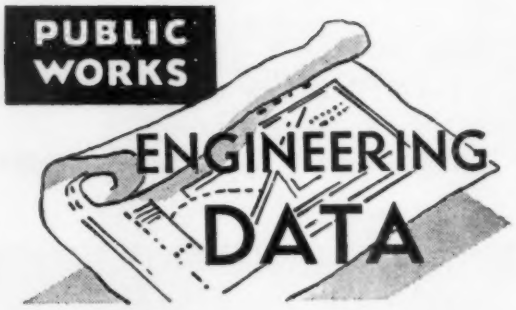
So ravenous is its appetite, so powerful its motor, and so fast its chipping action, it is equalled by no other. Yet it is so simple in design that maintenance is reduced to an absolute minimum.

Write *today* for full details. Better—ask for a prompt demonstration, without the slightest obligation.



ASPLUNDH CHIPPER COMPANY
505 York Road, Jenkintown, Pa.

By Actual Test the Fastest Chipper Made



New Refuse Collection Plan Tried in Toledo

A revised plan for refuse collection has been proposed by the City Manager of Toledo, O., based on the report of a study committee. This plan will be tried out in one collection zone and final adoption will depend on the results of the test.

The proposal for reorganization calls for rezoning the City from the present five waste-collection zones to four zones and reducing the number of collection routes from 250 to 160. There would be five districts per zone and eight collection routes per district.

Each route in the proposed districts is to represent a day's work for one crew. Under the present system the standard collection crew consists of one driver and three collectors. This would be changed under the new plan to a standard crew of five men consisting of one driver and four collectors.

The five-man crews would handle all alley collections and street collections where pickups can be made from both sides of the street at the same time. A three-man crew, a driver and two collectors, would handle collections where pickups can be made only from one side of the street at a time.

At the present time the collectors are averaging 121 pickups per collector per day. Under the proposed plan the average number of collections would increase to 160 pickups per day per collector. It is suggested that four foremen take charge of the services in each of the four zones, with each foreman supervising the collection services of eight trucks with crews of 36 to 38 men. At the present time there is a fleet of 57 trucks, 50 required for daily collections and seven maintained for emergency replacements. Under the proposed reorganization there would be four trucks detailed as replacements and 30 trucks used for daily operations.

Factors in Developing Street Improvement Timing

An improvement priority system for city streets has been developed by Vallejo, Calif., based largely on previous state highway department procedures. A formula is used to grade the various streets on the basis of 100 points. Structural sufficiency has a maximum of 40 points—15 points for surface conditions, 15 points for maintenance costs, and 10 points for drainage. Traffic volume is given a maximum of 40 points—10 points for present traffic volume and 30 points for probable future traffic volume. For safety the maximum is 20 points—10 points based on the accident rate, five points for sidewalks, and five for street lighting. So that the city would not expend its budget on a relatively few high priority streets consideration was given to costs. The number of vehicle miles travelled on each street per day was computed. An algebraic expression was developed,

if it can't pass these tests don't put it underground!

- **Is it rust and rot-proof?**
- **Is it acid and detergent-proof?**
- **Does it provide permanent protection against ALL corrosive wastes?**
- **Is its interior smooth enough and its diameter large enough to permit free flow of wastes . . . eliminate clogging?**
- **Will it handle harsh drain-cleaning compounds?**
- **Will it withstand the extra stresses of heavy backfill loads?**
- **Can it withstand the acids and gases generated by ground garbage?**
- **Can it stand extreme temperature changes without cracking?**
- **Is it backed by a long-term written guarantee?**

Substitute materials can pass some of these tests . . . but only *Clay Pipe* can pass them *all.*

And now new, longer, stronger Clay Pipe speeds up installation . . . cuts material and labor costs. Specify and install Clay Pipe—the only pipe with *all* the features you can trust. *It never wears out.*

C-458-4

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington, D. C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, Calif. • 100 N. La Salle St., Rm. 2100, Chicago 2, Ill. • 206 Mark Bldg., Atlanta 3, Ga.

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SEE NEENAH FIRST

More and more building contractors specify NEENAH fine quality construction castings FIRST. The Neenah line also includes manhole frames and covers, catch basin inlets and many other items to meet any construction requirement. Write today for your free copy of Catalog "R," second edition: 140 pages with pictures and description.

NEENAH FOUNDRY COMPANY

NEENAH, WISCONSIN

Chicago Office — 5445 N. Neva Ave., Chicago 31, Ill.

using the grading formula times the cost divided by the service rating to procure the total number of priority points. The streets having the lowest number of points received the highest priority for improvement.

Sanitary Engineering Career Promotional Materials

"Engineering Your Health" is the title of a film scheduled to be released April 1 by the Public Health Service. It is designed to portray sanitary engineering as a desirable professional career and is aimed specifically at the freshman and sophomore collegiate groups who are thinking about engineering. The film is accompanied by a question-and-answer brochure to help orient the vocational guidance specialist or science teacher arranging the showing. The 13.5-minute film, in sound and color, may be borrowed, rent free, from U.S. Department of Health, Education and Welfare Regional Offices or from Public Inquiries, Public Health Service, Washington 25, D. C.

Available from the same offices about March 15 is a comprehensive, multi-colored vocational guidance brochure entitled, "Toward a Healthier World: Your Career in Sanitary Engineering." About 16 to 20 pages long, the brochure is written in simple, direct language for interested secondary school students.

County Engineering Practices and Procedures

A questionnaire by the Editors of PUBLIC WORKS to County Engineers in 1957 brought in 824 replies. At the time of answering the questionnaire, concrete pavement construction was planned by 50 counties; bituminous paving by 553; bituminous resurfacing by 423; and stabilization by 305. Bridges or culverts of more than 20-ft. span were planned by 518.

Traffic control signals of the stop-and-go type were reported in use by 104 counties while 254 reported on traffic line markings; and 228 said they made their own new and replacement warning and directional signs. Aerial surveys were reported planned by 123 counties.

Chemical weed and brush control was scheduled for the summer of 1957 by 458 of the 824 counties; snow and ice control by rock salt or calcium chloride was planned by 335; 127 contemplated use of these chemicals for road construction; and 193 for dust control.

Equipment immediately needed, as determined by this spot check, includes 214 front end loaders; 66 power shovels; 61 traffic line markers; 54 asphalt distributors; 29 pick-up type street sweepers; and correspondingly large numbers of many other items of county-used equipment.

Requirements for Annexation

Before San Bruno, Calif., will annex new areas, five basic points are considered: (1) Will the commercial or industrial acreage of the city be increased by the annexation? (2) Will the per capita valuation of the annexed area exceed that of the existing community? (3) Will annexation give the city control over fringe areas which need improvement? (4) Will the storm water run-off from the area be a responsibility of the city? (5) Will the area, if not annexed, be able to use city facilities without contributing to their cost? For the past five years, subdivision regulations have included requirements for streets, curbs, sidewalks, street lighting, sewers, drainage facilities, street trees, and street signs.

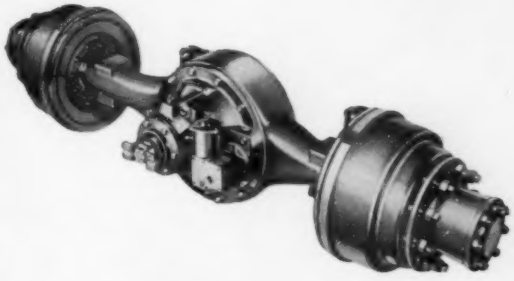
IN EATON 2-SPEED AXLES

REDUCES STRESS AND WEAR

ADDS TO AXLE LIFE • CUTS MAINTENANCE

KEEPS TRUCKS ON THE JOB • LOWERS OPERATING COST

Eaton's exclusive planetary construction distributes gear-tooth loads over four "planet" gears, holding stress and wear on any one gear tooth to a minimum. Completely locked out in the high speed range, these four gears rotate only slowly in the low speed range. The result is quiet operation, easy clash-free shifting, minimum wear, materially longer axle life. This rugged planetary design, plus forced-flow lubrication enables Eaton 2-Speeds to establish outstanding performance records. Eaton 2-Speeds also reduce stress and wear on engines and all power transmitting parts; they make it possible for trucks to haul more, quicker, longer, at lower cost.



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Eaton Axles in Trucks Today.
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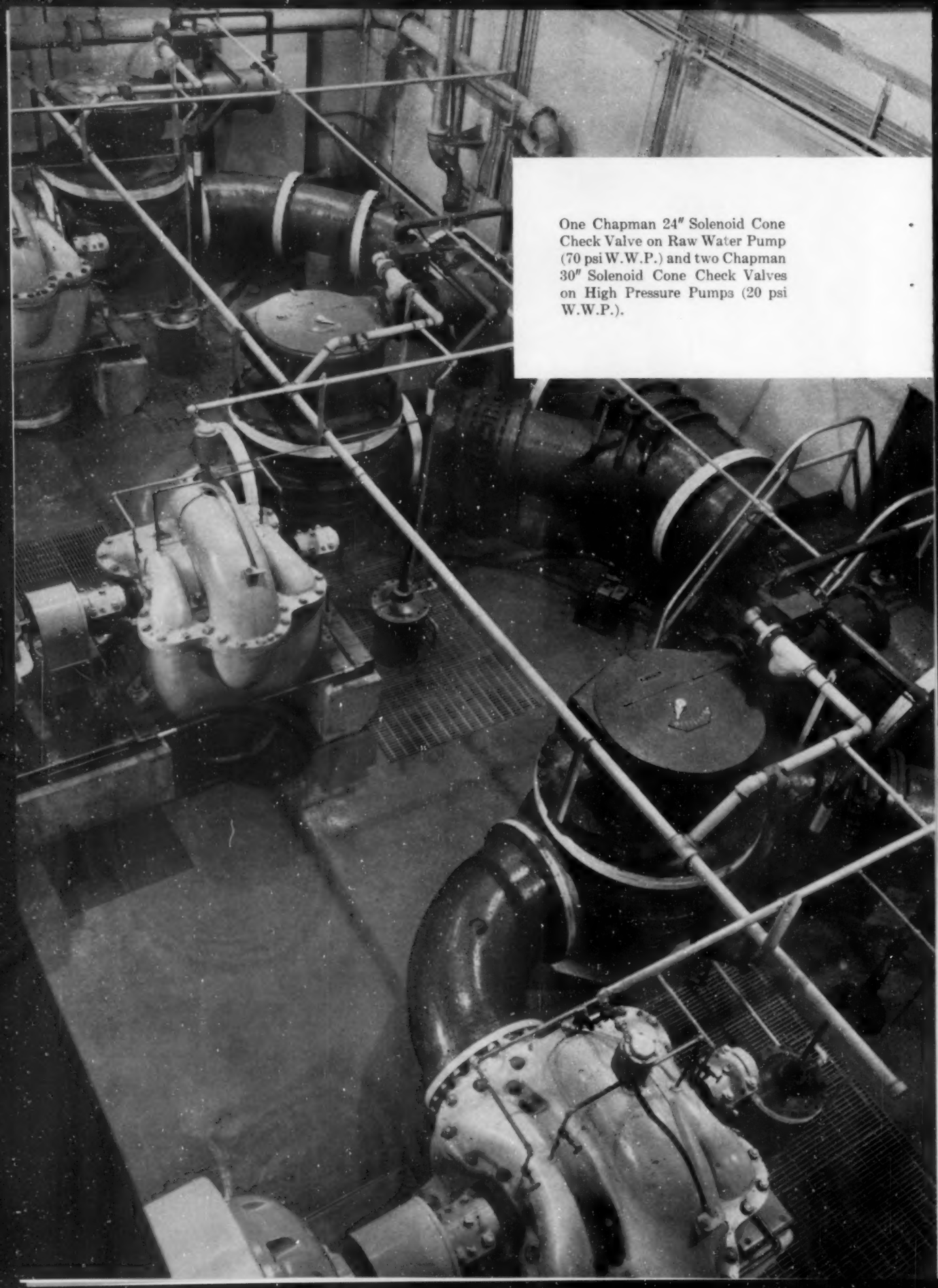
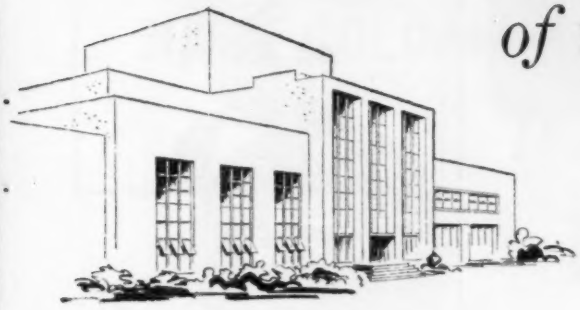
PRODUCTS: Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioners Fastening Devices • Cold Drawn Steel • Stampings • Gears • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



One Chapman 24″ Solenoid Cone Check Valve on Raw Water Pump (70 psi W.W.P.) and two Chapman 30″ Solenoid Cone Check Valves on High Pressure Pumps (20 psi W.W.P.).

The **CHAPMAN** *Part of the New Filtration Plant in Trenton, New Jersey*



Eastern Engineering Co.
Atlantic City, New Jersey
General Contractors

Turbine Equipment Company
Westfield, New Jersey
Mechanical Contractors

Mayor Donal J. Connolly
Trenton, New Jersey
Director of Public Works

J. N. L. Reid
Trenton, New Jersey
Chief Operator of Water Dept.

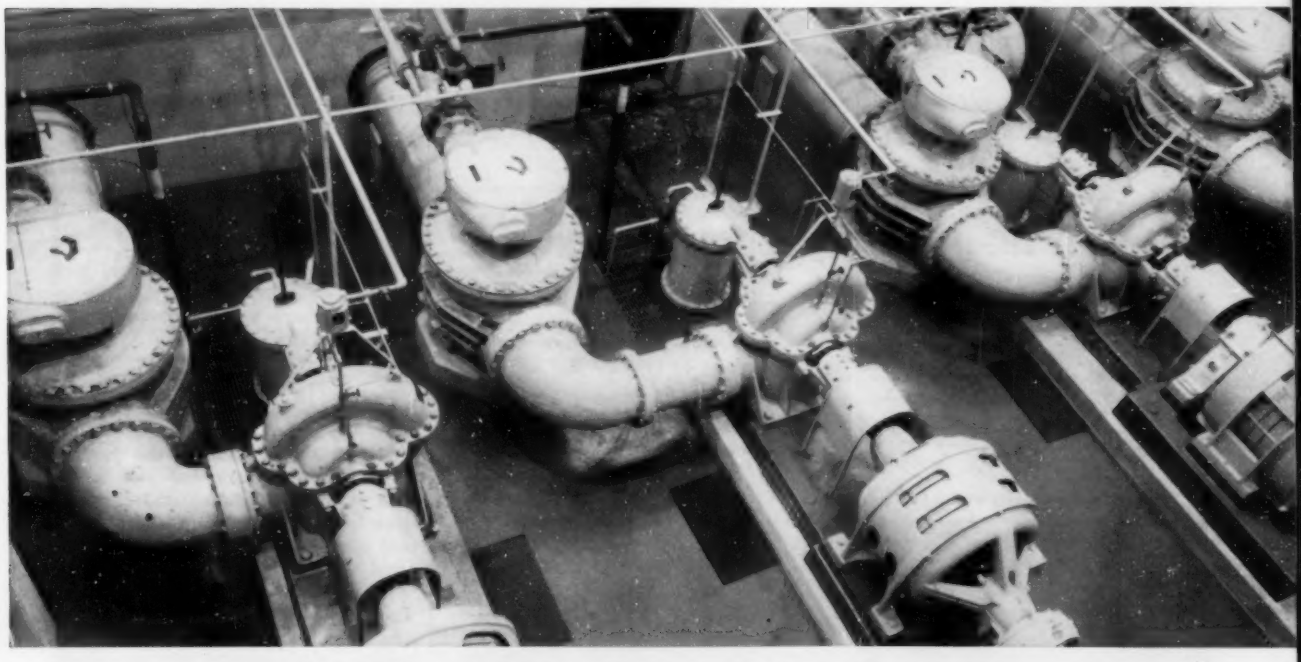
The water department of Trenton has an extensive improvement program well advanced. The new filtration plant is a notable phase. Donal J. Connolly, Mayor and Director of Public Works, plans to make the water supply system of that city one of the best in the country.

Much is involved. Nothing is overlooked. The most advanced methods, the newest equipment is used throughout the new filtration plant. See it, at your first opportunity. See it and you'll find the newest of everything. You'll find Chapman Valves working with equipment of other leading manufacturers . . . working to serve a community better.

The **CHAPMAN** *Valve Manufacturing Co.*

INDIAN ORCHARD, MASSACHUSETTS

For over 75 years, Chapman has devoted its entire facilities to the valves of today and tomorrow . . . designing them, developing them, building and testing them. Chapman has the engineers, the metallurgists and manufacturing facilities to give you the valves you need. Write, and we'll get right on the job.



Three Chapman 24″ Solenoid Cone Check Valves on High Service Pumps (70 psi W.W.P.) and one Chapman 30″ Solenoid Cone Check Valve on Raw Water Pump (20 psi W.W.P.).

Cut Steel or Cast Iron Pipe up to 12" EASIER and FASTER

WITH THE *NEW* REED

HINGED 4-WHEEL
PIPE CUTTER

- Closed Frame Construction assures complete rigidity with less weight.
- 4-Wheel design needs minimum swing of handle.
- 4-Point pipe guide aligns cutter for perfect tracking of wheels and a right angle cut.
- Quickly interchangeable wheels for steel or cast iron.
- Needs only 3" space to pass under 12" pipe.

For ditch work or similar close-quarter operations these new Reed Cutters are practically indispensable and fully justify replacing whatever cutting equipment you are now using.

You can, for example, cut 8" steel pipe in less than five minutes, and cast iron pipe even faster.

Available in five sizes for steel or cast iron pipe from 1" to 12".

FOR FAST TURNING IN TIGHT SPOTS—
USE THE IMPROVED REED CHAIN WRENCH

Handles range from 10" to 60" in length.

You can tighten up or "back off" without taking wrench from pipe.

These improved chain wrenches will do anything an ordinary pipe wrench will do... and do it easier, better and faster. Ideal for ditches or tight corners.

Grip securely with no play, yet they have a ratchet-like action.

Unquestionably guaranteed to be the most efficient tools you have ever used. See your jobber or write for literature.

REED MANUFACTURING COMPANY
ERIE • PENNSYLVANIA

FLY EMERGENCE FROM LANDFILLS

It was with considerable interest that I read the article in the February issue, "Fly Emergence from Sanitary Landfills," written by Ralph J. Black and Allan M. Barnes. I would appreciate it very much if you would send me two tear sheets of the above mentioned article at your earliest convenience.

J. M. Cotter
Department of Public Works,
City of Saint Paul,
Minnesota

TIMEWASTERS: THE FOX AND THE DOG

I note, with a great deal of pleasure, that the February issue of PUBLIC WORKS has gone back to the old "Timewaster" articles. I enjoyed this column back in the 1930's. I sent in several problems, including one about the dog that smelled the fox, some 3300 feet, Dec. 1936. I hope you continue this column, as long as I get the magazine.

H. A. Blunk
City Engineer
City Hall
Martinsville, Indiana

INDEXES AND METER REPAIRS

We were re-arranging our magazine files the other day and in deciding what to keep and how well we could use these on file I wondered if there is an author—subject index available to your PUBLIC WORKS articles over the years? The AWWA recently put out a bound index for 1940-55 which has proved most useful, and added greatly to the value of the journal file. Your magazine has had many fine reference articles and I would like to have a ready index to them.

I have become quite interested lately in meter shop practice since we are in the process of building a shop now. For your information I am attaching a copy of our last year's expenses, and we are grati-

WIN A CASH PRIZE!

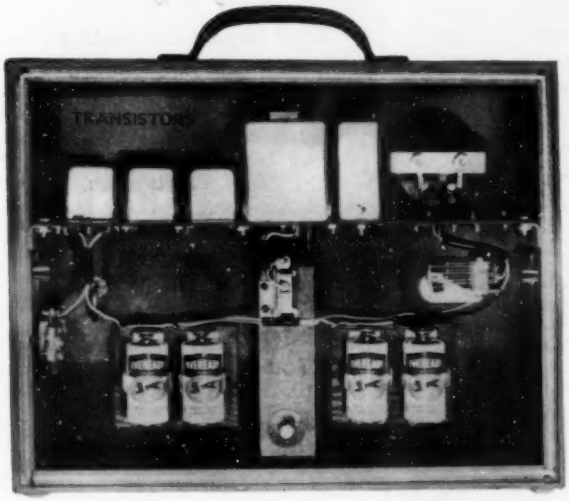
NAME GOLDAK'S 25th ANNIVERSARY

TRANSISTORIZED

PIPE LOCATOR

GOLDAK'S 25th Anniversary

NEW PRODUCT



DESIGNED FOR PINPOINT DETECTION OF UNDERGROUND PIPES, CABLES, MAINS, LATERALS, VALVES

THE MOST EFFECTIVE PIPE LOCATOR OF THE CENTURY

Goldak commemorates 25 years of Manufacturing the World's Finest Electronic Locating Equipment with a completely new Transistorized Pipe Locator. To help celebrate this occasion, The Goldak Company invites the readers of the publication, its friends and customers, to participate in a Contest naming this revolutionary Pipe Locator. The winner will receive a $100 SAVINGS BOND and the winning name will be used in all future advertising. To help you select a suitable name, some of the features and specifications of this machine are listed below:

FEATURES:

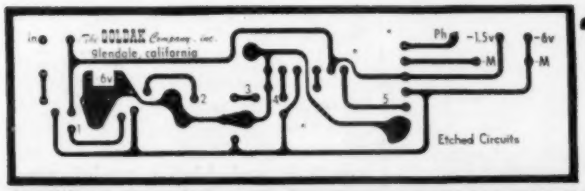
Transistors, printed circuit boards and packaged circuits for better locating; small sized flashlight batteries for maintenance savings.

Transistors and other components encapsulated preventing temperature, humidity, shock and vibration problems.

SPECIFICATIONS:

Operating Weight
Transmitter—4½ lbs.
Receiver—4¾ lbs.
Circuit
Transmitter—one transistor
Receiver—six transistors
Batteries
Transmitter—
4 size C flashlight cells
Receiver—
4 size C flashlight cells
Sensitivity—18 ft. depth range, approximately 200 ft. average tracing distance.

For further information, write The Goldak Company for Literature and name of your nearest dealer.



The GOLDAK Company, Inc.
Leading Electronic Manufacturers
Since 1933

1545 W. Glenoaks Blvd.,
Glendale 1, Calif.

CONTEST RULES

Everyone over 21 years of age is eligible to enter this contest with the exception of the employees and families of The Goldak Company, their advertising agency and this publication. Simply print the name you suggest where indicated in the coupon, your Name, Address, City and Where Employed. Mail to "CONTEST" The Goldak Company, 1544 West Glenoaks Boulevard, Glendale 1, California. All entries must be postmarked no later than midnight, March 15, 1958. All names become the property of The Goldak Co. Winner will be notified by mail.

I suggest the following name for the
TRANSISTORIZED PIPE LOCATOR

_____

Name _____

Address _____

City _____ Zone _____ State _____

Where Employed _____

MANUFACTURERS OF THE WORLD'S FINEST LOCATING EQUIPMENT

SPECIAL DELIVERY for liquids and gases in all branches of industry is assured with Kraloy Rigid Polyvinyl Chloride (normal and high impact) Plastic Pipe . . . with virtually no maintenance or policing. You install Kraloy PVC—and forget it. That's why millions of feet of Kraloy Plastic Pipe are in use today, because Kraloy PVC is inert and can never rust, rot, or corrode, is not subject to electrolytic action, handles abrasives, slurry and most Ph factors, is scale resistant. Superior flow characteristics (C factor = 150+) permit use of smaller diameters. Installation costs 50% less, due to light weight and ease of handling.

Write for complete information and literature.

KRALOY RIGID PVC PLASTIC PIPE NORMAL AND HIGH IMPACT

Kraloy Plastic Pipe Co., 4720 E. Washington Blvd., Los Angeles, Dept. PW-38

Subsidiary of the Seamless Rubber Co., a Rexall Drug Co. *Subsidiary*

DESIGNED TO AUTOMATICALLY HANDLE RESIDENTIAL, INDUSTRIAL AND COMMERCIAL WASTES

COMPLETE DATA, SPECIFICATIONS AND DRAWINGS AVAILABLE—WRITE

ZIMMER & FRANCESCON P. O. BOX 359, MOLINE, ILLINOIS

fied to find we compare very well with other cities' average costs now.

Between standardization of meters and our preventive maintenance program which has been operating since pre-war days, our repair cost is quite low. We have found that being in an aircraft center has its advantages, too, since we can get many of the meter parts made locally at considerable saving over normal lists.

Things are looking up now that it has rained—but planning to prevent another water shortage is taking all our time.

Henry J. Graeser,
Superintendent
Water Dept.
Dallas, Texas

Editor's Note: We have an annual index but no cumulative index covering more than a single year.

• • •

Civil Engineer Available

A young man (28 years old) with a 1951 BCE degree in civil engineering from the National University of Ireland is available. His experience has included road maintenance and construction, with responsible charge of 100 men, in North Borneo; hydraulic and survey work with the Public Works Dep't., of Dublin, Ireland; and general construction experience. He has a visa for permanent residence in the United States and intends to reside here permanently. Address: Eoin O'Colman, 2404 Roosevelt Ave., Berkeley 3, Calif.

Southern Municipal & Industrial Waste Conference

The Seventh Southern Municipal & Industrial Waste Conference will be held March 27 and 28 at Duke University, Durham, N. C., under the general direction of Prof. J. W. Williams of the Department of Civil Engineering. The University of North Carolina and North Carolina State College will participate jointly in the program, as in the past. Those who have attended past conferences are familiar with the interesting and highly useful programs that are followed. Additional information is available from Prof. Williams.

Water Rate Schedule for Warren

A new water rate schedule has been adopted by Warren, Minn., as follows: 1st 3,000 gallons, $3; next 7,000 gallons, 75 cents; next 30,000 gallons, 50 cents; and all excess gallons, 30 cents. For bulk water, 1,000 gallons will cost $1 and the minimum charge will be 50 cents.

Three Rust-Oleum DIFFERENCES that save you time, money and metal!

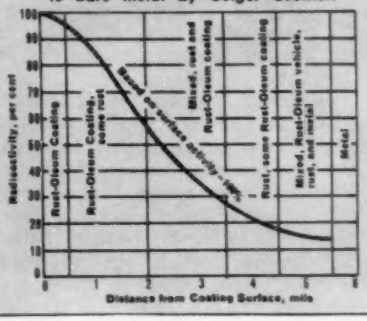
GOES ON FASTER

No tedious surface preparations usually required — just scrape and wirebrush to remove rust scale and loose rust — then brush Rust-Oleum 769 Damp-Proof Red Primer right over the remaining rust.

STOPS RUST

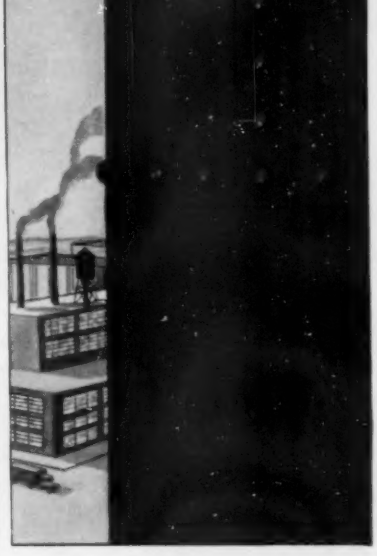
Rust-Oleum's *specially-processed* fish oil vehicle works down through the rust into the tiny, microscopic pits in the bare metal where it drives out air and moisture to *stop rust.*

Chart shows results of tracing radio-activated Rust-Oleum through rust to bare metal by Geiger Counter.



LASTS LONGER

Applied over rust, Rust-Oleum lasts longer for the *over-the-years protection* you need. It resists sun, salt water, salt air, fumes, heat, humidity, moisture, weathering.



These are just a few of many important *differences* that separate Rust-Oleum from ordinary coatings. When you consider that Rust-Oleum covers approximately *30% more area,* depending upon surface condition and porosity . . . and the fact that Rust-Oleum finish coatings, with the same fish oil vehicle, are available in nearly every color for *double protection* . . . it's just good, common sense to use Rust-Oleum. Prompt delivery from Industrial Distributor stocks. Write for illustrated literature with color charts.

RUST-OLEUM®

STOPS RUST!®

Rust-Oleum is distinctive as your own fingerprint. Accept no substitute.

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☐ Complete literature with color charts.

☐ 30-page report on Rust-Oleum penetration.

☐ Nearest source of supply.

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RUGGEDNESS? SPEED? PORTABILITY? LOW COST? MANEUVERABILITY?

YOU GET 'EM ALL IN A Pow-R-Ditcher

Model 524T Pow-R-Ditcher

The largest of the Pow-R-Ditchers, the powerful 524T digs an 8" to 24" ditch and is especially designed for wide foundation footings, gas, water and sewage lines. Hydraulically controlled steering, 5 speed truck transmission and 2-way dirt conveyor are just a few of its features. A self-propelled unit that digs for LESS because it COSTS SO MUCH LESS!

Model 4T Pow-R-Ditcher

A smaller ditcher (6"-14" ditch) for the light construction field, the 4T Pow-R-Ditcher is easily transported in a pick-up truck. Excellent for laying gas pipe, water and cable lines and for digging home foundation footings. Same size moving parts as the 524T. It is fast, rugged and low priced.

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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Swimming Pools Operated by Cities

Nissen v. Redelack, 246 Minn. 83, 74 N.W. (2d) 300, 55 A.L.R. (2d) 1428, a Minnesota case decided Dec. 30, 1955, was an action for damages for the death of an eight-year-old boy drowned in a swimming pool operated by the City of St. Paul. Although the City made certain nominal charges at times in connection with the use of the pool, the revenue so obtained made up only a small part of the total operating expenses. No charge was made for the use of the pool by the child on the day in question.

Judgment was for the defendant, on the ground that the City was engaged in a governmental function, and was therefore immune from liability for its negligence. This decision is in accord with the prevailing view, as regards swimming pools or bathing beaches which are operated *without* profit. However, there are some cases to the contrary in several states, including Missouri, Montana, New York, Pennsylvania, South Dakota, Virginia, and West Virginia. And where a profit is made, the result is generally to hold it to be a proprietary activity, carrying no immunity.

Is a Curve a Defective Condition?

Clouse v. County of Dawson, 161 Neb. 544, 74 N.W. (2d) 67, 55 A.L.R. (2d) 991, a Nebraska case decided Dec. 30, 1955, was an action by a motorist against a county for personal injuries and property damage, based on the alleged defective condition of the road by reason of a failure to erect a sign warning of a curve in the road.

The plaintiff's car ran off the road and into a canyon when he failed to make the turn. Evidence showed that the turn (which was a half-turn to the left) was rounded and banked, that the road was well graded and graveled and of adequate width for ordinary use (24 feet wide), and that the 10-foot strip between the side of the road and the canyon was covered with grass.

The court held that the road, including the curve, was not so hazardous as to require a sign warning of the curve, and that there was no need either to warn persons using the road of the existence of the canyon. "The liability . . . to warn users of a highway does not extend to hazards beyond the boundaries of the highway except as they may endanger travelers within its boundaries who are using ordinary care."

The holdings in other states vary, as to the need for signs warning of curves, depending on the particular facts.

Antlers' Sidewalks

Town of Antlers v. Benson, 247 Fed. (2d) 437, an Oklahoma case decided by the United States Court of Appeals July 26, 1957, was an action against the Town of Antlers, Oklahoma, to recover damages for injuries sustained by reason of a fall caused by alleged defects in a public sidewalk.

The sidewalk in question was four feet wide, and there was an abrupt elevation on it, approximately three and one-half to four inches high, completely across the sidewalk, caused by growing tree roots underneath the sidewalk. A trellis had been built over the sidewalk by the adjacent owner, and had become covered with vines. The nearest street light was 150 feet south. The plaintiff, while walking along the sidewalk at night, stumbled over the raised portion of the sidewalk and was injured.

It was found by the court that the Town did not have or maintain any sidewalk department, and had never built, authorized, constructed, repaired, or exercised jurisdiction or control over sidewalks generally, or the sidewalk upon which the injury occurred. The cement sidewalks in the Town had been constructed by the owners of the business or resi-

Planning better roads

by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt

Stabilization of Gravel Now Required on New York's "Erwin-Program" Roads

The "Erwin Program"—New York's law to provide state aid for the improvement, repair and reconstruction of certain town highways—was recently amended in a most significant way. This law now reads that gravel or other surfacing "*shall* be stabilized with a suitable binding material..." Formerly, the law simply stated that such surfacing "may be stabilized."

With this amendment to the "Erwin Program" in effect, it is now the job of Town Highway Superintendents and other officials to select the most effective gravel stabilizer for their roads. At the same time, they must also select a stabilizer which is low in cost, readily available, and easy to store and apply.

In a great majority of cases, the gravel stabilizer which meets all these requirements best is rock salt. And, in fact, rock salt has already been widely used

Genesee County road stabilized with low-cost Sterling Rock Salt. Gravel surface is hard, long-wearing, virtually dustless even in driest weather. Due to Sterling Rock Salt's antifreeze action, this road has unusual resistance to frost penetration.

on many New York State "Erwin-Program" roads—as well as others throughout the state.

One excellent example of rock-salt-stabilization under the "Erwin Program" comes from Genesee County, New York. This county's experience is typical of many where rock salt has helped to provide better roads—at lower costs. According to Genesee County Highway Superintendent Robert T. Carrier, the use of rock salt as a stabilizing agent has proved unusually successful on his roads. "The gravels in our area," he writes, "are particularly well suited to the use of rock salt, since there is a well-proportioned blend of hard material and clay binder."

Commenting further on rock salt as a stabilizer, Carrier says: "Recent research has shown us that 12 tons of rock salt per mile of road surface gives a satisfactory and long-lasting job. The maintenance of such stabilized sections of road has decreased—leaving more time and money for new construction and reconstruction. Where all-weather surfaces have been placed on these stabilized bases, they have remained sound, and maintenance has been at a minimum.

"Rock salt on our 'Erwin-Program' roads has also increased the density of their bases, eliminating the penetration of water. This, in turn, has reduced the freeze-thaw cycle common to our climate and subsequent frost action. Rock salt provides a good base material for future all-weather wearing surfaces. And, in short, it's helping us to save what we have, and allowing us more time and money to catch up with the ever-increasing demands of traffic."

In New York—and many other states—the product most often chosen for

Sterling Rock Salt was also used on this Genesee County road. It was applied, mixing the top 3 to 4 inches. Other operations: mechanical mixing, blending, wetting, rolling, final blading and rolling.

road stabilization is Sterling Rock Salt, produced by International. This rock salt has all the advantages that city, state and county highway officials demand: it provides positive, long-lasting stabilizing action; it's low in cost; it's easy to store and apply—and it's always readily available when and where you need it.

Sterling Rock Salt, of course, is effective as a stabilizer for road shoulders and bases—as well as the wearing surface. With road bases this product is particularly important because *a road is only as good as its base.*

FREE TECHNICAL ASSISTANCE ON ROAD STABILIZATION

Rock-salt-stabilization procedures vary with particular soil and road conditions. For expert advice on how stabilization can work in *your* area, contact International. An International "Salt Specialist" will be glad to help you work out an effective, money-saving rock-salt-stabilization program for your system. He'll show you facts and figures on actual road-stabilization jobs now under way. And he'll work with you in lining up such details as application procedures, specs, etc. No cost or obligation. Just contact your nearest International sales office.

SPECIAL OFFER. For detailed technical information on rock-salt stabilization write for International's free series of booklets, "Better Highways." Address: International Salt Company, Inc., Scranton 2, Penna.

Sales offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; and Richmond, Va.

FOR ROADS, INDUSTRY, FARM, AND HOME—

STERLING SALT

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BRILLIANT PERFORMANCE

T-3 PRECISION THEODOLITE

Yes, brilliant performance based on inspired design and most scrupulous Swiss craftsmanship throughout the instrument and its accessories.

The Wild T-3 is an instrument that holds unchallenged supremacy in its class for accuracy, versatility, and maintenance-free reliability in a broad range of work requirements.

Complete data on the Wild T-3 will be sent on request.

Full Factory Services

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tial properties on which the sidewalks front.

Before bringing the present action, the plaintiff released the abutting property owner of liability. The Town claimed that since the primary obligation was that of the property owner, his release automatically also released them. However, the court held that the primary liability is that of the Town, and that they are not released of their statutory liability to keep the streets and sidewalks in repair by release of the abutting property owner.

A judgment for the plaintiff for $4500 was therefore affirmed.

Lights Out

Goodman v Raposa, 312 Pac. (2d) 65, was a California case decided June 19, 1957, in which the City of Stockton and others were sued for damages to a boy who was injured by an auto while crossing the street at an intersection. The City was named as defendant solely because the traffic light had been turned off and no officer was directing traffic.

The traffic lights had been turned off because of a short circuit in the wiring at a point somewhere near the center of the street. They had been flashing both ways simultaneously. Repairs had not been completed at the time of the accident four days later. Testimony indicated that the job could have been completed within 20 to 24 man-hours of working time.

The Court held that the City was not liable, as it had not created or maintained a dangerous or defective condition of the street. Failure to direct traffic while the lights were being repaired may have been negligence, but even if so, the City was immune from liability on that score as that is a governmental function. The statute relating to defective and dangerous conditions of the streets does not apply to such activities.

• • •

Additional Data on the A-G Soil Penetrometer

In the article entitled "Subsurface Exploration with the A-G Soil Penetrometer" (PUBLIC WORKS for December, 1957, pages 105-106), space limitations precluded the publication of all the material submitted by the authors. Additional data covering recommended bearing values of nine soils as determined by A-G penetration tests is available in tabular form and may be obtained by writing to Professor Louis J. Goodman, Department of Civil Engineering, Syracuse University, Syracuse 10, New York.

BIG

CONCRETE PIPE BY AMERICAN-MARIETTA

American-Marietta 144" reinforced concrete pipe installation used by Ohio Edison Co. for a triple discharge line over 1000 feet long at Stratton, Ohio.

A-M trucks delivering concrete pipe directly to the job site. Nationwide location of plants assures quick delivery of your order by truck, rail or barge.

Another example of

PROGRESS IN CONCRETE

BIG diameter reinforced concrete pipe—delivered to the job in quantity—calls for a manufacturer with BIG facilities. American-Marietta not only has the necessary equipment and engineering background to produce such pipe in quantity, but the ability to deliver it *when* and *where* needed from any of its many plants located strategically from coast to coast.

So if you're thinking BIG—about a BIG job with BIG savings in time and money—think of AMERICAN-MARIETTA COMPANY.

Our technical staff will be pleased to assist you with your pipe problems.

AMERICAN-MARIETTA COMPANY

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HUNDREDS OF INSTALLATIONS FROM COAST TO COAST

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FACTORY-BUILT SEWAGE LIFT STATIONS

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MAXIMUM EFFICIENCY WITH MINIMUM MAINTENANCE

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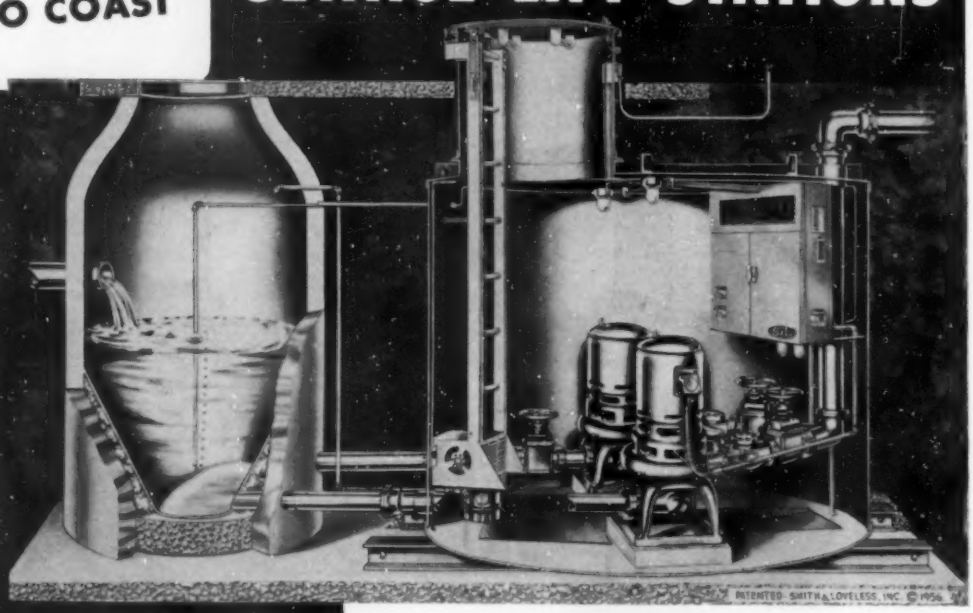
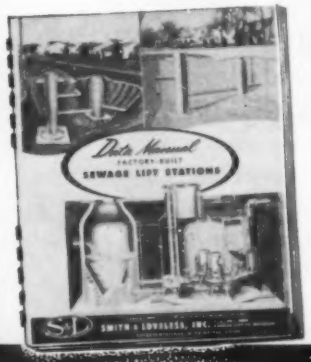
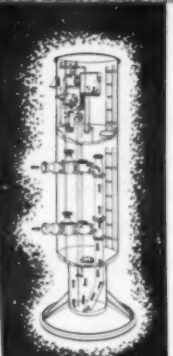
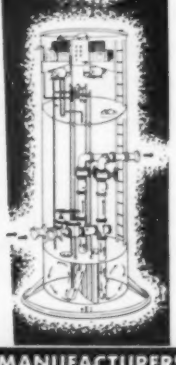


Write for your copy of the Smith & Loveless lift station data manual. Contains over 100 pages of design notes, selection charts, dimension drawings, specifications, diagrams and a list of representative installations. Just drop a card or letter to Dept. 40 and your free copy of Smith & Loveless data manual will be sent promptly.

No obligation.







Smith & Loveless specialize in building America's finest sewage lift stations. Hundreds of installations, from coast to coast testify to the superior quality of Smith & Loveless factory-built sewage lift station.

Smith & Loveless offer a complete line of lift stations with capacities of 20 G.P.M. to 4500 G.P.M. per pump or ejector. The Smith & Loveless sewage lift station is a complete unit and shipped to the job site ready to install.

- An integrated design, each piece proven by the test of time
- Precision assembled by factory experts
- Automatic dehumidifier to eliminate condensation
- Central control cabinet, prewired and color coded
- Structure protected by S&L "Versapox" and packaged anodes
- Factory tested before shipment
- Quickly and easily installed
- Especially designed for minimum maintenance

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Smith & Loveless, Inc.

P. O. BOX 8884 KANSAS CITY, MISSOURI

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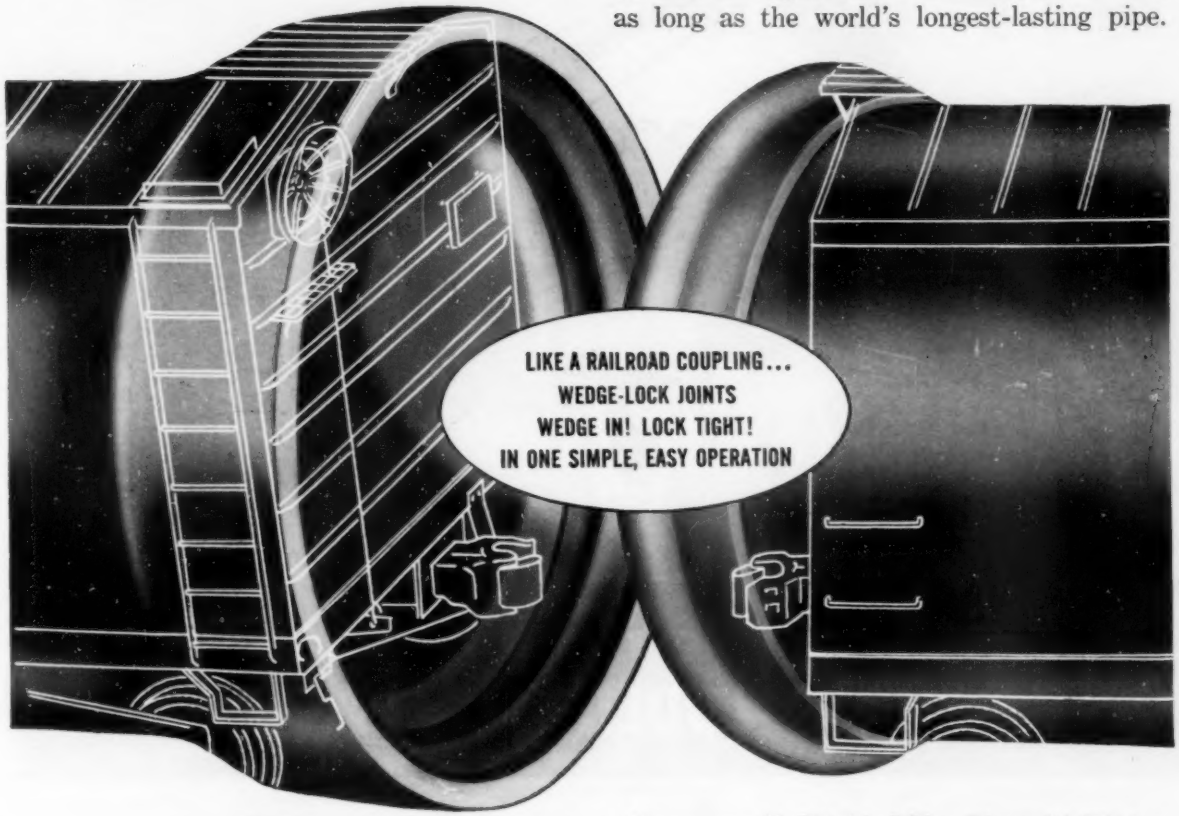
NEW Wedge-Lock* JOINTS

WEDGE IN! LOCK TIGHT!

Stop Infiltration and Roots

Patented Wedge-Lock Joints wedge in and lock tight in one simple, easy operation . . . in continuous compression . . . provide the tightest line . . . stop infiltration and root penetration . . . give easier, faster installation . . . keep installation costs down . . . permit strict adherence to engineered sewer designs . . . last as long as the world's longest-lasting pipe.



Always specify Vitrified Clay Pipe with Wedge-Lock Plastisol Joints.

Write to Listed Manufacturers for literature or an actual Wedge-Lock demonstration.

*Patented. T.M. Reg. U.S. Pat. Off.

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THE FACTORY-JOINTED CLAY PIPE AVAILABLE NATIONALLY FROM LOCAL MANUFACTURERS

Order Wedge-Lock from any of these Vitrified Clay Pipe Manufacturers:

Cannelton Sewer Pipe Company, Cannelton, Ind.
Clay City Pipe Company, Uhrichsville, Ohio
The Evans Pipe Company, Uhrichsville, O.
Gladding, McBean & Company, Los Angeles 54, Cal. (Sold under trade name, "SPEED-SEAL")
The Logan Clay Products Company, Logan, Ohio
Oconee Clay Products Company, Milledgeville, Ga.
Pacific Clay Products, Los Angeles 54, Calif.
Pine Hall Brick & Pipe Company, Winston-Salem, N.C.
Pomona Terra-Cotta Company, Greensboro, N.C.
The Robinson Clay Product Company, Akron 9, Ohio
The Stillwater Clay Products Company, Cleveland 16, Ohio

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Only 60 seconds from sewer to truck

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Sewer cleaning revolutionized with NEW TRUCK-LODER BUCKET MACHINE

- Bypass street dumping!
- Bucket Contents dumped automatically!
- Two-man Bucket Machine Crew!
- Easier to operate! Simple to maintain!
- Streets kept free of sewer deposits!

Sewer deposits dumped automatically ...DIRECTLY INTO TRUCK!

No more unsanitary sewer deposits on the street.

Releases man formerly needed for dumping bucket and shoveling into truck.

The Truck-Loder makes bucket machine operation a two-man job.

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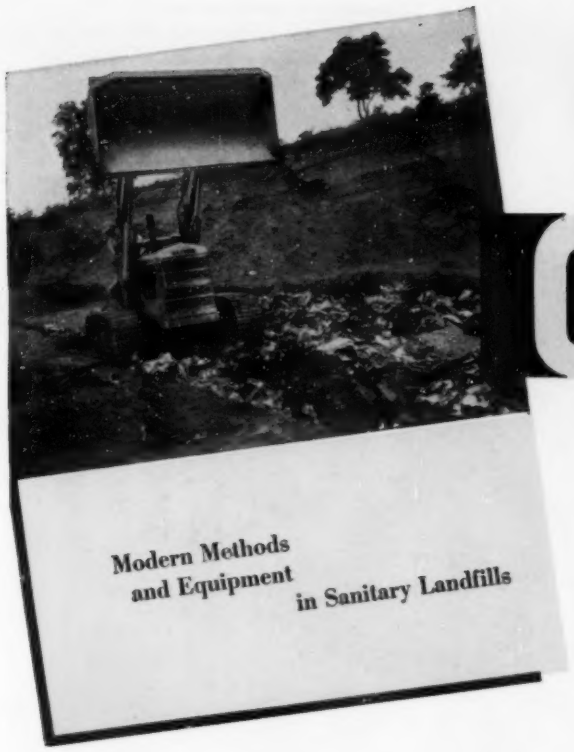
351 W. JEFFERSON BLVD., DALLAS, TEXAS

WORLD'S LARGEST MANUFACTURER OF SEWER CLEANING EQUIPMENT



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This just-printed bulletin carries the most up-to-date data, pictures and explanation of sanitary landfill—its methods and equipment. Shows how communities like yours are reaping important benefits from this cleaner, more satisfactory garbage and refuse disposal method—in cutting costs, eliminating pollution, odor, disease, while reclaiming wastelands. It's important reading for communities now having sanitary landfill—as well as for communities wanting to know more about it—because of its emphasis on the newest of ways to do it.

Look at its helpful contents:

- What exactly is sanitary landfill?
- Two types of modern sanitary landfill.
- Land needs for sanitary landfill.
- Area requirements check list.
- Selection of site.
- Topography and cover material.
- Step-by-step operations of a typical and efficient sanitary landfill —a factual picture report.
- Equipment needs for sanitary landfill.
- Explanation of types of equipment.
- Equipment selection guide.
- A review of Oliver tractor-loaders and spreaders for sanitary landfill operations of all sizes.

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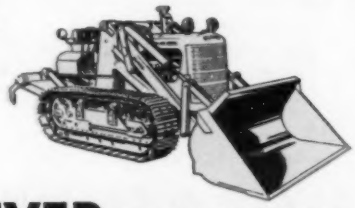

OLIVER **THE OLIVER CORPORATION**
19300 Euclid Avenue, Cleveland 17, Ohio
a complete line of industrial wheel and crawler tractors and matched allied equipment

Call your Oliver distributor for copies or mail coupon.

The Oliver Corporation
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Gentlemen:
I would like to have ( ) number of copies of your new bulletin on modern sanitary landfill.

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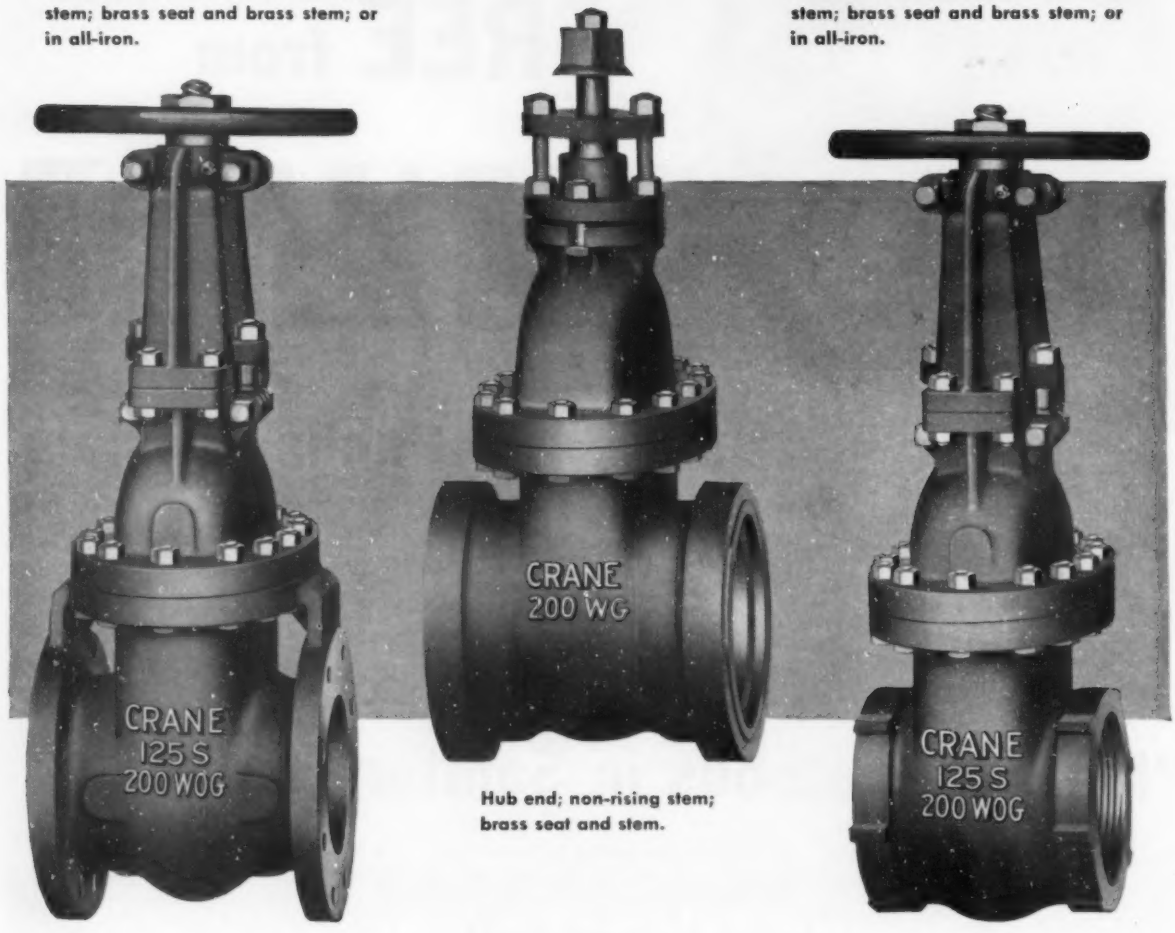
Flanged end; outside screw and yoke. Available with brass seat and steel stem; brass seat and brass stem; or in all-iron.

Screwed end; outside screw and yoke. Available with brass seat and steel stem; brass seat and brass stem; or in all-iron.



Hub end; non-rising stem; brass seat and stem.

Crane Iron Body Gates–Versatile Valves for Water and Sewage Services

Look to Crane for better performing 125-pound iron body wedge gate valves. Improved design gives them greater strength and important operational advantages. As a result, these valves offer dependable performance on a wide variety of services . . . easy maintenance . . . long life.

Among the advantages of Crane iron body wedge gates are:

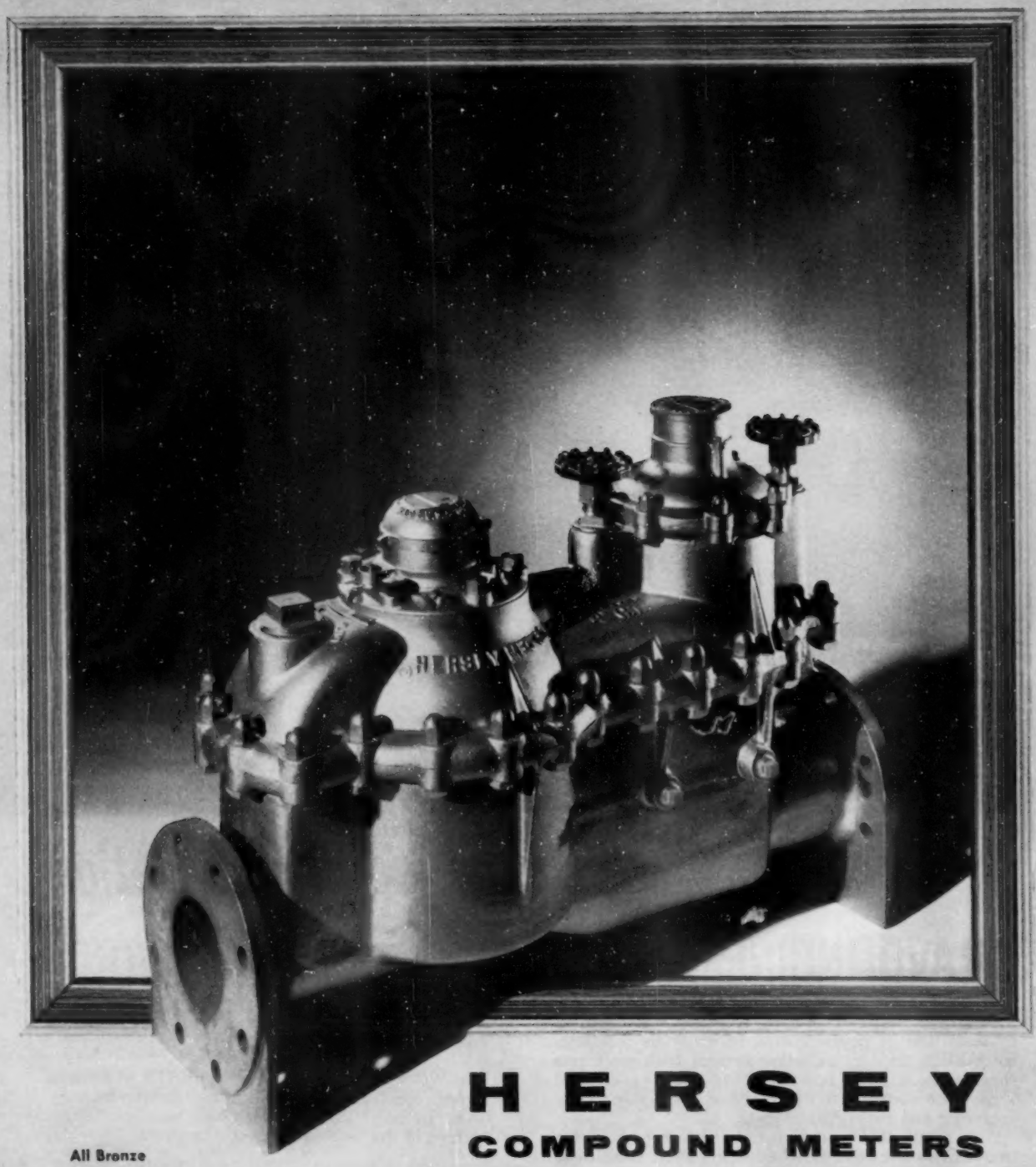
- *Oval body and bonnet,* with extra metal where needed most.
- *No bonnet joint leakage*—More bonnet bolts on closer centers insure uniform bolt load distribution on bonnet joint and gasket.
- *Long disc guides* seat discs properly . . . minimize drag on seating surfaces . . . prolong valve life.
- *Shoulder-type seat rings* prevent rings from loosening in service.
- *Two-piece ball-type gland* prevents binding on stem even when gland bolt nuts are pulled up unevenly.
- *Exceptionally deep stuffing box* can easily be repacked under pressure when valves are wide open.
- *Available in 19 sizes*—2 inches to 48 inches—all-iron or brass trimmed. In addition, Crane makes companion valves in globe, angle, check, quick-opening and Underwriters' patterns.

For complete descriptions of Crane iron body gate valves, consult your Crane Representative, or write to Crane Co. at the address shown below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855 — Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas



HERSEY
COMPOUND METERS

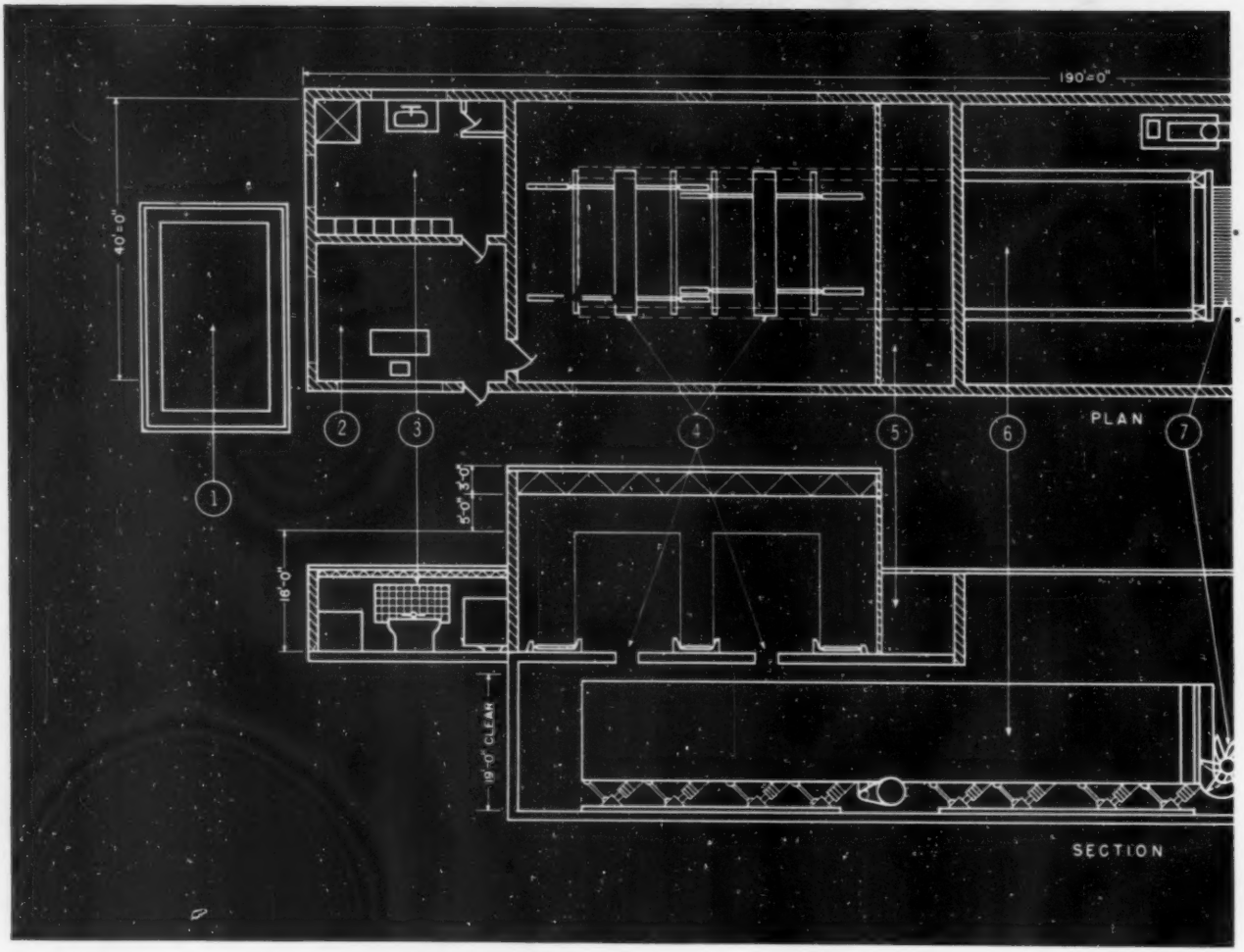
will give you better and longer service than any other Compound Meters

only HERSEY *gives you such a large selection of sizes to fit your every need.*

All Bronze Case, sizes 2"–3"–4"–6" inclusive as illustrated above also Iron Case Meters *(not shown here)* in sizes 8"–10"

HERSEY MANUFACTURING COMPANY
DEDHAM, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO — SAN FRANCISCO — LOS ANGELES



for low-cost incineration

DRAVO INCINERATORS COST LESS TO BUILD

The Dravo Continuous Flow Incinerator is designed to make use of developments in materials handling, combustion and air pollution control that meet two considerations: One—add to efficiency of the operation, Two—be economical in first cost and contribute to low operating and maintenance costs.

As a result, this type of installation can be built for **two-thirds the cost of other equivalent facilities.** Here are two of the construction design principles that contribute materially to this low cost:

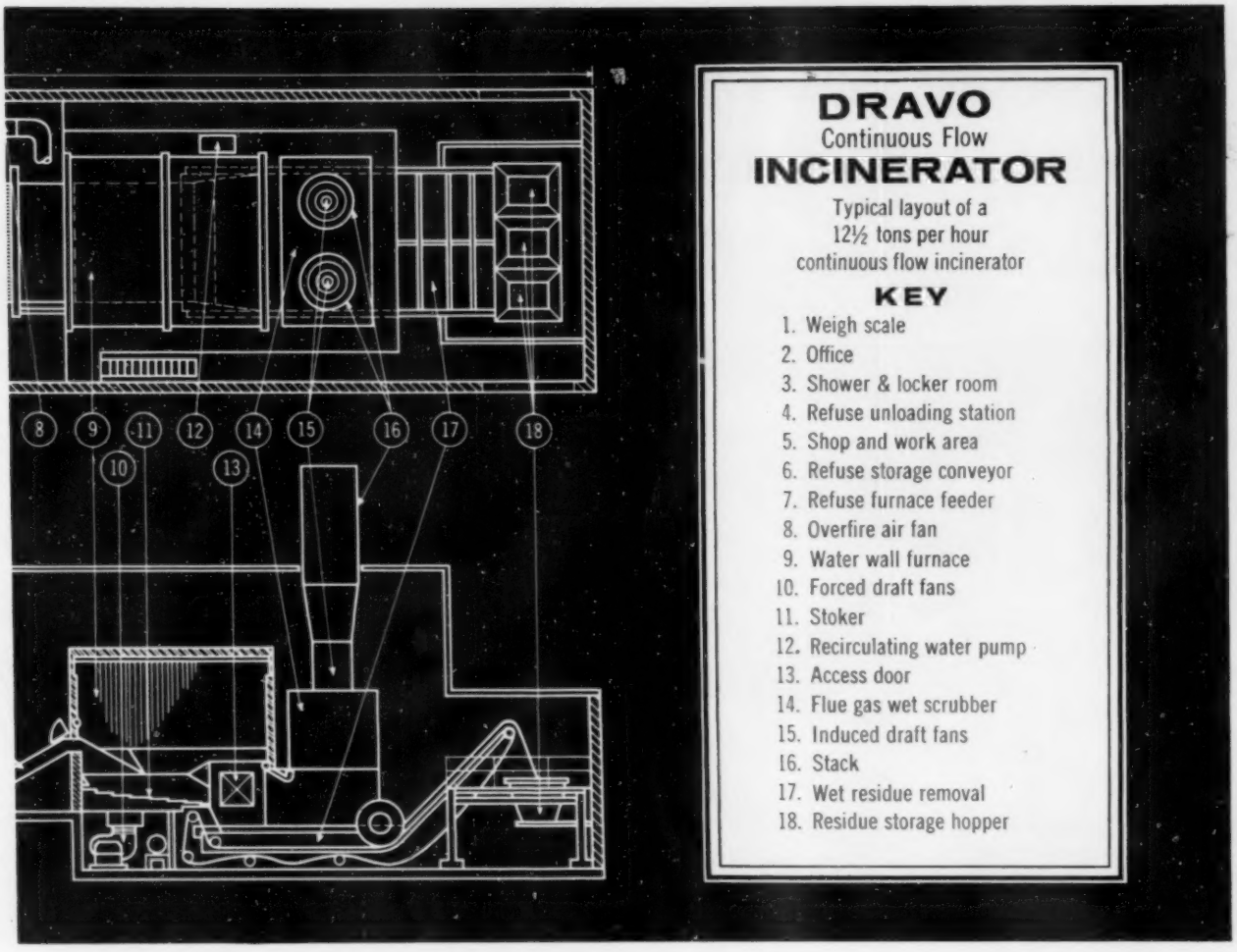
1. The Continuous Flow Principle. The use of a storage-type conveyor permits direct unloading of refuse trucks. This system avoids the expense of separate storage facilities and the accompanying unloading and handling facilities.

2. The Water-Wall Furnace Principle. The water-wall furnace eliminates use of thick, expensive refractory walls. In many installations, waste heat can be recovered in the form of hot water or steam.

The Dravo Incinerator provides high temperature combustion, which, with the wet scrubber system, assures the absence of fumes and fly-ash. A plant may therefore be built in heavily populated areas. The lower construction cost inherent in this design makes incineration economically feasible for any community.

DRAVO

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders • dredging
fabricated piping • foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges



DRAVO
Continuous Flow
INCINERATOR

Typical layout of a
12½ tons per hour
continuous flow incinerator

KEY

1. Weigh scale
2. Office
3. Shower & locker room
4. Refuse unloading station
5. Shop and work area
6. Refuse storage conveyor
7. Refuse furnace feeder
8. Overfire air fan
9. Water wall furnace
10. Forced draft fans
11. Stoker
12. Recirculating water pump
13. Access door
14. Flue gas wet scrubber
15. Induced draft fans
16. Stack
17. Wet residue removal
18. Residue storage hopper

of municipal refuse . . .

DRAVO INCINERATORS COST LESS TO OPERATE

One of the basic principles on which design of the Dravo Incinerator is based is Continuous Flow. This is more than simply a conveying system, since it is designed to move refuse from the unloading end to residue storage with minimum operator attention. Flow is automatic, allowing a comparatively small staff to operate the facility. Drive-through unloading arrangement assures maximum use of trucks.

Collection costs are lower, too. Refuse does not have to be separated and cleanliness of the plant permits central location where haulage distance can be shortened. Here are a few of the features which provide economical operation:

- No storage pits—no cranes or crane operators.
- No waiting to unload trucks, no need for backing or turning areas.
- No massive refractory wall furnaces—no extensive shut downs for relining of furnace walls.
- Complete combustion of all burnable refuse means less residue.
- Automatic operation of Continuous Flow system reduces operating personnel.

Low-cost construction and low-cost operation are the keys to a really efficient municipal refuse disposal system. Our engineers will be glad to work with you in developing the most economical solution to your particular problem. Write Dravo Corporation, Dravo Building, Pittsburgh 22, Pa.

process equipment • pumphouses and intakes • river sand and gravel • sintering plants
slopes, shafts, tunnels • space heaters • steel grating • towboats, barges, river transportation

DRAVO
CORPORATION

FIRST...

Get the facts about refuse collection from...

DAYBROOK

Power Packer load test performance proves operating advantages of continuous

F.C.P. Action

Daybrook invites you to compare Power Packer operation in your city.

Write for a TIME-LOAD DEMONSTRATION to be scheduled at your convenience on an established route of your choice.

Address Dept. PW-2.

F.C.P. (force, crush, pack) Action means all refuse materials are forced beneath the hydraulic-operated crusher panel . . . is crushed, and in this highly compacted form, forced into the truck body. The refuse remains in a "packed" condition in the body until dumped. THE RESULT . . . more collections, more distance per route . . . heavier loads, and fewer trips to the dump.

Continuous F.C.P. Action keeps the crew moving all the time. No costly time delays are required awaiting loading operations. It is fast and safe for crews and operators . . . economical for contractors and municipalities.

DAYBROOK Speedlift TRUCK EQUIPMENT

DAYBROOK Speedlift DUMP BODIES—HOISTS—POWER LOADER—POWER PACKER—POWER GATE

DAYBROOK HYDRAULIC DIVISION *YOUNG SPRING & WIRE CORPORATION, BOWLING GREEN, OHIO*

It takes just two steps to assemble the FLUID-TITE Coupling. Lubricate the tapered edge of the gasket. Then slide in the pipe.

Major Advance In Waterworks Industry. K&M's exclusive FLUID-TITE Coupling provides permanent, water-tight, root-tight connections. Allows deflection of up to 5°. Assembled in any weather.

SLIDE IT IN QUICK... IN 2 EASY STEPS

IT'S "K&M" ASBESTOS-CEMENT PRESSURE PIPE WITH EASY-TO-INSTALL FLUID-TITE COUPLING

Installation is fast and economical! It doesn't require skilled labor, heavy machinery, or heavyweight coupling pullers. Install it in any weather.

The seal grows tighter as the pressure climbs! Coupling rings expand as water mains fill. Rings have holes on one side for self-energizing action.

It's practically indestructible! "K&M" Asbestos-Cement Pressure Pipe is non-tuberculating, non-electrolytic, and corrosion-resistant. Its first cost is often the last cost. Pressure remains normal—pumping costs stay low.

Write today for more information.

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

All over the country more and more Sewage Treatment Plant Operators and Professional Sanitation Engineers say:

"Sure we were fooled once, but not again. Now we specify 'Cloroben', not 'Cloroben or equal'. Because we've learned the hard way that Cloroben has no equal!"

Only **CLOROBEN** has the precise formulation of chlorinated hydrocarbons processed in exactly right proportion with special and exclusive dispersing agents.

You find that the more difficult your odor or sanitation condition, the more definite the proof that **CLOROBEN** *is more than twice as effective as slightly cheaper substitute emulsifiable chlorobenzes.*

To control odors and suppress sulfide formation in sewage, for septic tanks, cesspools, chemical toilets, no other product of its kind compares to **CLOROBEN** in safety, efficiency and true economy.

Specify and use **CLOROBEN**, and only **CLOROBEN**, for results you know you can depend on.

Yours on request: Technical Brochure, complete with evaluation and performance data, and describing **CLOROBEN** applications. Write Dept. PW-3

CLOROBEN CHEMICAL CORPORATION

115 Jacobus Avenue, South Kearny, New Jersey Subsidiary of Standard Chlorine Chemical Co., Inc.

now a residual pre-emergence herbicide with

7 *safety features*

GEIGY SIMAZINE* 50W

STOPS WEEDS AND FIRES BEFORE THEY START

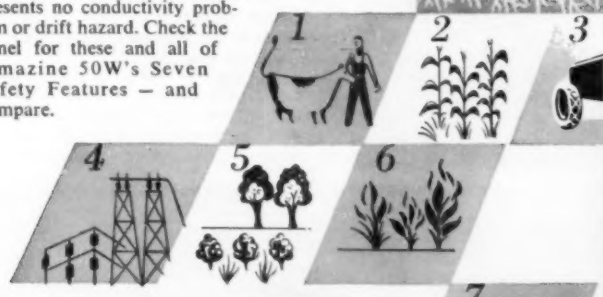
Weed control is an old problem to maintenance men. Now Geigy's pre-emergence herbicide Simazine 50W provides a new and better solution – makes weed control *easier* because it is long residual; *safer* because of its Seven Safety Features; and *more effective* because it stops weeds before they start.

ONE APPLICATION PER SEASON

Simazine 50W reduces application costs in time, labor and material. At the rate of 10 lbs. per acre, one pre-emergence application controls annual grassy and broadleaf weeds for an entire season. At the rate of 20 lbs. per acre, one pre-emergence application controls most perennial weeds as well as annuals.

SEVEN SAFETY FEATURES

Maintenance men especially appreciate Simazine 50W's Seven Safety Features. This new herbicide is safe to humans and animals, non-flammable, non-corrosive, non-abrasive, and presents no conductivity problem or drift hazard. Check the panel for these and all of Simazine 50W's Seven Safety Features – and compare.



check these **SIMAZINE 50W** *7 safety features*

1. **SAFETY TO HUMANS AND ANIMALS** Extremely low toxicity. No need for protective clothing.
2. **SAFETY TO ADJACENT VEGETATION** Minimum lateral leaching. Remains where it is applied.
3. **SAFETY TO SPRAYING EQUIPMENT** Non-corrosive or abrasive to equipment.
4. **SAFETY NEAR ELECTRICITY** Relatively low electrical conductivity.
5. **SAFETY FROM DRIFT HAZARD** Works through roots—little or no toxicity to foliage.
6. **SAFETY FROM FIRE HAZARD** Non-flammable. No application hazard.
7. **SAFETY ON VALUABLE LAND** Not a permanent soil sterilant.

GEIGY AGRICULTURAL CHEMICALS
Division of Geigy Chemical Corporation
Saw Mill River Road, Ardsley, New York

WRITE FOR TECHNICAL DATA

For additional product data, Technical Service information, or the name of your nearest Simazine 50W distributor, address: Geigy Agricultural Chemicals, P. O. Box 430, Yonkers, New York.

200 years Geigy

ORIGINATORS OF Geigy DDT INSECTICIDES

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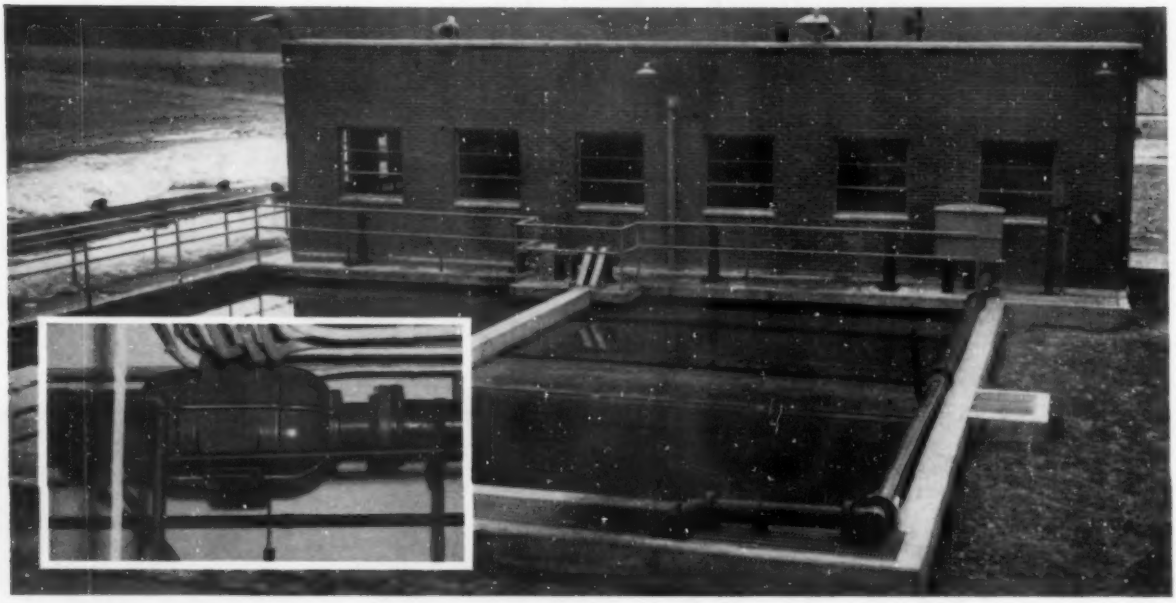
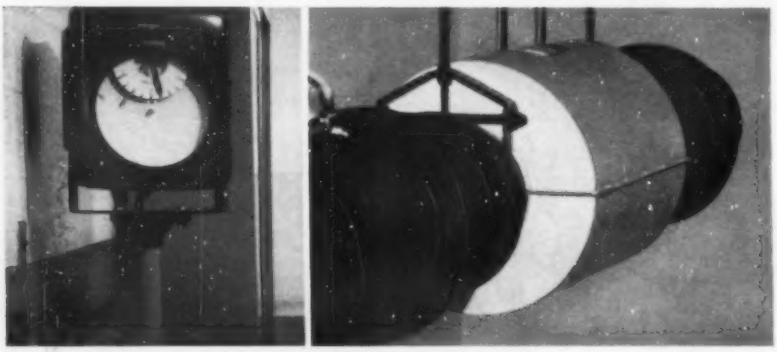
Line Restriction



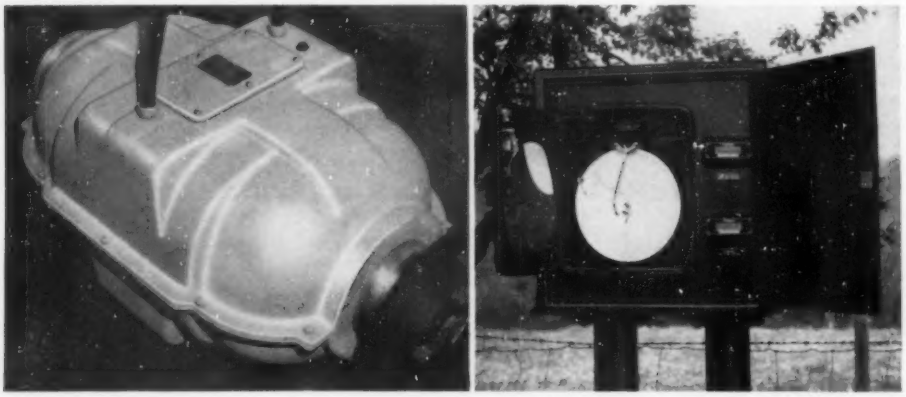
SIDNEY, OHIO

A Foxboro Magnetic Flow Meter was installed right in the return activated sludge line at Sidney's modern sewage plant. Supervisor reports it's been operating so smoothly that they haven't had to touch it.



FRAZER, MICHIGAN

12" Foxboro Magnetic Meter measures and totalizes raw sewage influent at Clinton Township treatment plant. Supervisor reports accuracy perfect — no variations — no maintenance since it was installed.



MEDFIELD, MASS.

Town of Medfield and nearby State Hospital have independent water supplies — use common storage facilities. Foxboro Magnetic Meter measures and records flow rates in both directions. Two integrators, next to recorder, keep separate running totals of both flow rates.

Problems Eliminated!

for these municipal utilities equipped with Foxboro Magnetic Flow Meters

Introduced three years ago, the Foxboro Magnetic Flow Meter has proved its superiority for measuring water, sewage, sludge and other treatment plant flows.

Foxboro Magnetic Meters are installed the same as a length of pipe. Measurement is linear and is transmitted by electric cable to centrally-located Dynalog* Flow Recorders. There are no line restrictions of any type. That means no added pressure drop . . . no seals, purges, meter runs, or straightening vanes.

Maintenance on the Magnetic Flow Meter is practically nil. There are no pressure taps to get plugged or frozen. No moving parts to foul.

Look over the installations on these pages. And for complete details write for Bulletin 20-14B. **The Foxboro Company, 263 Norfolk St., Foxboro, Mass., U.S.A.**

*Reg. U. S. Pat. Off.

Other Progressive Communities Installing Foxboro Magnetic Flow Meters

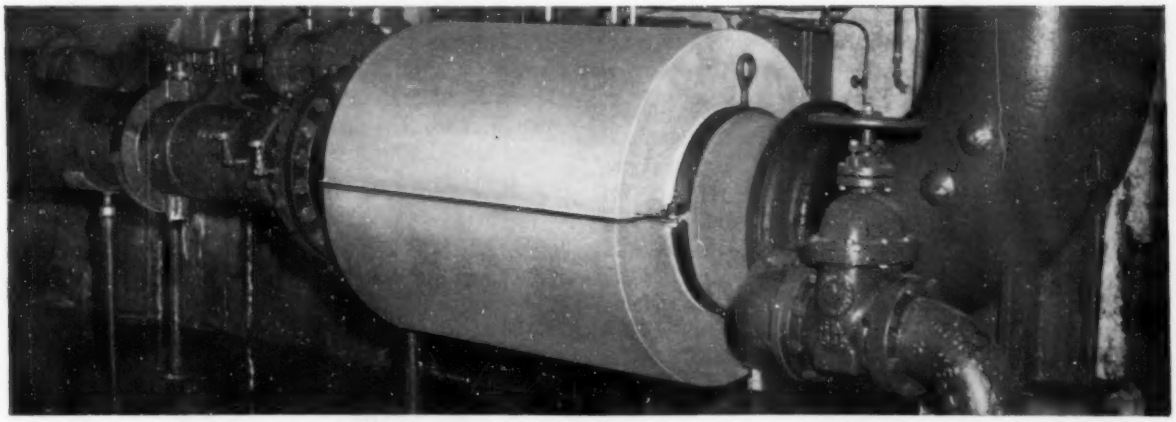
Benton Harbor, Michigan	— raw sewage
Hayward, Calif.	— water
Pittsburgh, Pa. (Allegheny County Sanitary Authority)	— raw sewage
Covington, Ohio	— return activated sludge
Warren Township, Michigan	— raw sewage and sludge
Bloomfield Township, Michigan	— water
Seattle, Washington (Lake City Sewage Plant)	— sludge
Milwaukee, Wisconsin	— sludge
Piqua, Ohio	— sludge
Arkansas City, Kansas	— sewage

Meter sizes on these installations range from 3 inches to 6 feet.

CHICAGO, ILLINOIS

This 20" Foxboro Magnetic Flow Meter was installed in the South District Filtration Plant in April, 1956. Because it has no line restrictions, plant officials knew the meter would add no more pressure drop than an equivalent length of pipe. Note how it was installed directly downstream from an elbow.

FOXBORO
REG. U.S. PAT. OFF.



After an Idaho winter's test, a street superintendent says:

"THE CATERPILLAR NO. 12 MOTOR GRADER IS THE BEST MACHINE MADE"

Repairing winter damage to the streets of Boise, Idaho (population: 35,000), is the continuing assignment of this Caterpillar No. 12 Motor Grader. Now it's in its second blustery season on the job. Boise Street Superintendent Jim C. White comments: "We've run it eight and nine hours a day, six days a week, with no down time. I think it's the best machine made."

For snow removal, the No. 12 has a full line of hydraulic attachments: snow plow, snow wing, bulldozer, steering booster and moldboard shift. And Domor Snow Blowers and Elevating Graders are easily attached.

The No. 12 offers the exclusive new Preco Automatic Blade Control which makes it possible to control slopes within ⅛" in 10′ width. Other new improvements also help keep the No. 12 the standard of the industry. Redesigned front axle components give extra strength and longer life; an adjustable seat and a taller cab with better ventilation and 31% more window area increase operator efficiency; longer frame and tandem assure full utilization of No. 12's versatility—including use of 14.00-24 tires with chains.

About the long-life oil clutch White says, "We have to ride the clutch a lot—going over manholes and the like—but we've never had to adjust it." Other important features include a dependable CAT* Diesel Engine, a long radius, curved side shift rack that allows a full range of blade positions without changing links or adjusting the blade, and tubeless tires which reduce tire down time as much as 80%.

With the No. 12 at your command, you're ready for winter's assault. Let your Caterpillar Dealer show you how a No. 12 can save money for your municipality the year around. His complete parts and service facilities stand behind your investment, too.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

YOUR TAXPAYERS GET THEIR MONEY'S WORTH WITH CAT-BUILT MOTOR GRADERS

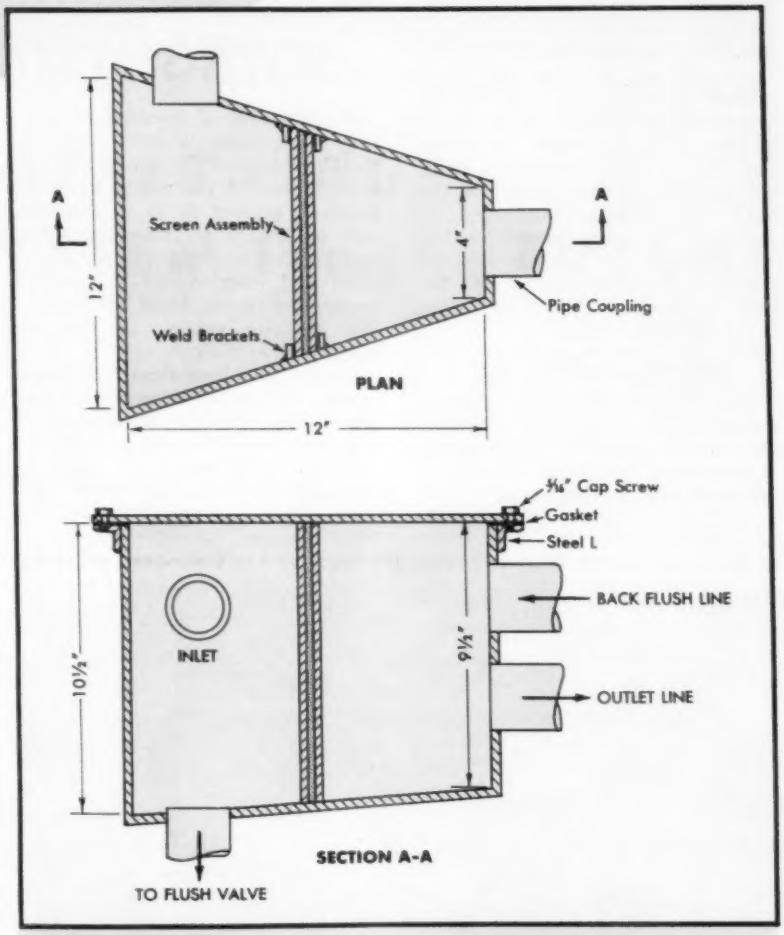
PUBLIC WORKS
Magazine
Volume 89, Number 3
MARCH, 1958

PRESSURE SCREEN
for SEWAGE EFFLUENT
KEEPS SPRINKLERS CLEAN

DALE WILSON,
Associate Engineer
and
NORMAN A. NESTE,
Director of Public Works,
Colton, California

A FULLY MODERN sewage treatment plant of the activated sludge type was completed and put into operation in 1950 to serve the City of Colton, California. By 1954, foaming of the primary clarifier became a problem of importance, probably due to the ever increasing quantity of household detergents being introduced into the sewerage system. In conformance with the usual practice, a cold water sprinkling system was installed to control the frothy accumulation from building up in the aerators. The sprinkling system consists of the feed line which draws effluent water from the chlorine contact tank, a small centrifugal pump to pressurize the system, and the pressure line which feeds 105 sprinkler heads mounted on four manifolds which encircle the primary clarifier and aeration tanks.

This system proved to be entirely satisfactory in preventing foam from building up as long as the sprinklers could be kept functioning. However, the unfiltered effluent, as taken from the chlorine contact tank, contains particles of matter, in solid and semi-solid state, which seriously impaired the operation of the sprinklers.



● **STRAINER design minimizes screen clogging with soft materials while effectively stopping small solid particles that would plug the sprinkler nozzles.**

A screen was then placed over the feed line inlet, but after only a few minutes of operation the screen became clogged with a soft flocculent type material. This obviously was not a satisfactory arrangement, so the screen was removed and the situation for the next two years was unchanged.

During this period, it was ritual each morning to clean as many as 90 sprinkler heads, requiring 1 to 1½ man-hours per day. Hal O'Hair, chief operator, while working on the problem, took notice of the fact that the particles causing sprinkler stoppage were almost invariably hard solids of a minimum diameter of 1/16 inch, indicating that the sprinkler heads would pass the particles of lesser diameter as well as the softer materials of a flocculent nature. Apparently, then, it was necessary to remove only the solid particles of 1/16 inch diameter or larger, and this could be accomplished by screening the pressure line, forcing the soft particles through the screen as they must be forced through the sprinklers, and stopping the occasional hard particles which would be certain to lodge in a sprinkler.

Working on the basis of his observations, Mr. O'Hair, with the aid of Forrest Wagner, who was assisting him at the treatment plant, worked out the basic plan for the screening chamber essentially as shown in the accompanying sketch. The idea was then presented to the engineering department, where the basic plan was refined and shop drawings were made.

Maintenance Time Cut

The unit was constructed and installed and has now been in service about three months. Sprinkler maintenance time has been reduced to less than two man-hours per week as compared to eight or ten man-hours per week previously.

Tracing the flow through the chamber, it is seen that the sewage effluent enters the chamber in the region of maximum sectional area, normal to the flow through the screen to prevent solids entering at high velocity from becoming embedded in the screen; also, the resulting turbulence probably effects a scrubbing action on the screen as a further benefit. The flow then progresses through the screen to the outlet, through a progressively smaller cross-sectional area, converting pressure to velocity, which results in the unit pressure on the entrance side of the screen being slightly higher than the unit pressure near the outlet to aid in forcing scum through the screen, maintaining a more uniform flow and reducing pressure fluctuations.

It may be noted in the photograph that the screening chamber is mounted directly over the re-aerator tank. This mounting permits the chamber and screen to be cleaned by flushing, which is accomplished merely by opening the flush valve and closing the outlet valve. If the screen remains clogged, the outlet valve is left open, the flush valve is left open, the back flush line is opened and the inlet valve is closed, thereby reversing the flow through the screen. This is not recommended unless absolutely necessary, as it introduces unscreened water into the outlet or sprinkler side of the screen and may necessitate the cleaning of one or more sprinkler heads.

The screening chamber as described has been very satisfactory and has substantially improved the efficiency of the plant maintenance, thanks to chief operator O'Hair.

● **INSTALLATION of this small strainer unit has saved 6 to 8 man-hours per week.**

MODIFIED STANDARDS REDUCE SEWAGE TREATMENT COSTS

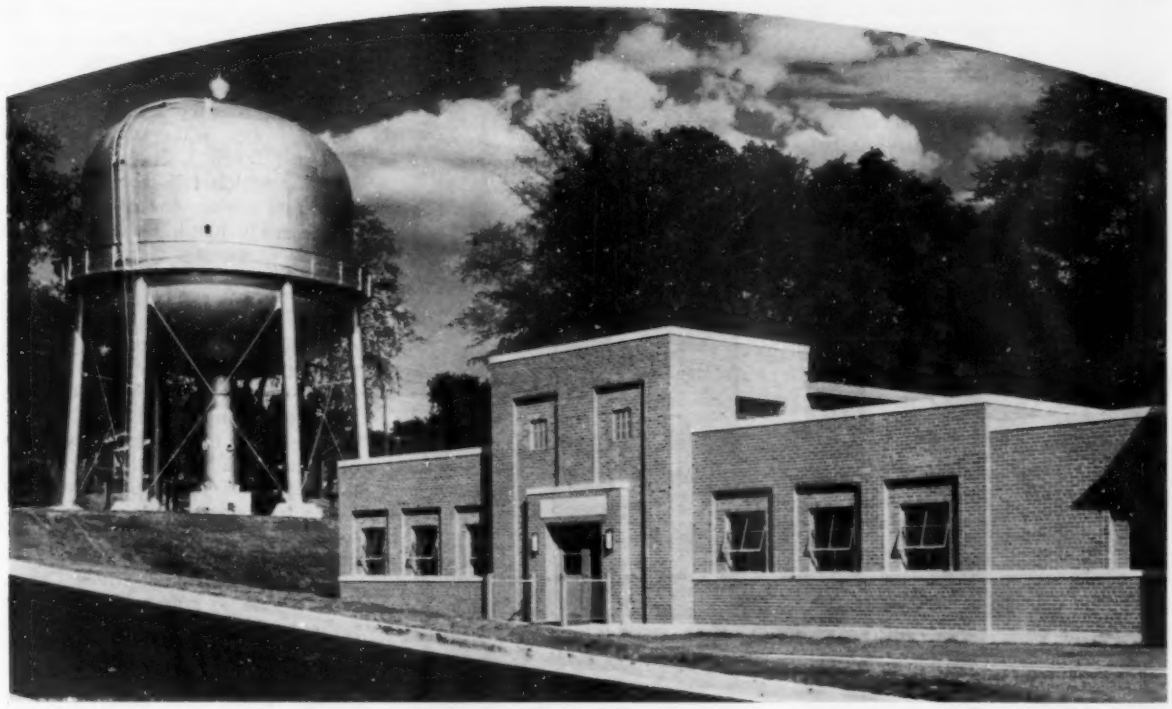
A great deal of research in sanitary engineering is being done at the University of Florida. The primary purpose of the most important research project is to reduce the cost of sewage treatment facilities and to effect economies in the operation and maintenance of existing sewage treatment plants in subtropical climates similar to that of Florida.

Although a long time is usually required before the results of research can be translated into practice or applied in the field, it became apparent soon after the research was started that sewage treatment processes were accelerated appreciably in the warm Florida climate, and that certain design standards developed in the northern states were much too conservative for Florida conditions. Consequently, the Florida State Board of Health modified its requirements on several important points. All are resulting in savings to the taxpayers.

The most important modifications based on the university research may be summarized as follows:

1. Reduction in the depth of trickling filters from 6 ft. to 4½ or 5 ft.
2. A one-third reduction in the size of sludge drying beds.
3. The use of Brooksville limestone, a native Florida material, is now permitted as trickling filter media. (This product would not be suitable in northern climates because it will not meet the sodium sulfate soundness test which simulates alternate freezing and thawing).
4. A 50 percent reduction in the area requirements for sand filters (i.e. from 100,000 gallons per acre per day to 200,000 gallons per acre per day when filters having properly graded sand are preceded by settling tanks).

The project was under the direction of Professors John E. Kiker and Thomas deS. Furman. This report was forwarded to us through the courtesy of Professor Kiker.



● TYPICAL building of Columbia Water Department. This one houses filters with 9 mgd capacity. Wash water tank at left.

DESIGNING a WATER SYSTEM for the FUTURE

GUY BROWNING ARTHUR

TO EVALUATE its existing and estimated future water demands Columbia, S. C., engaged Bruce P. Barber and Associates, who directed a study to determine the safe and dependable quantity of water available and to recommend courses of procedure for the future. The growth of the city and the increasing rate of water use resulted in dangerously thin margins of safety. The existing plant has a capacity of 28 mgd; in 1956, the average daily demand was 13.25 mgd; the maximum daily demand was 26.2 mgd; and the maximum hourly demand was at the rate of 41.5 mgd. The engineers recommended immediate enlargement of capacity to 42 mgd, with provision for future expansion to 60 mgd. Improvement in the distribution system was also recommended.

Columbia's population has increased from 54,496 in 1930 to 115,300 in 1956. It is expected to be 168,000 in 1966 at which time the average daily demand will be 17.5 mgd; the maximum daily demand will be 38.0 mgd; and the maximum hourly demand will reach a rate of 62.5 mgd. The 1976 figures will be 22.2, 52.6 and 84.5; the 1986 requirements will be 26.1, 67.3 and 108.0, respectively.

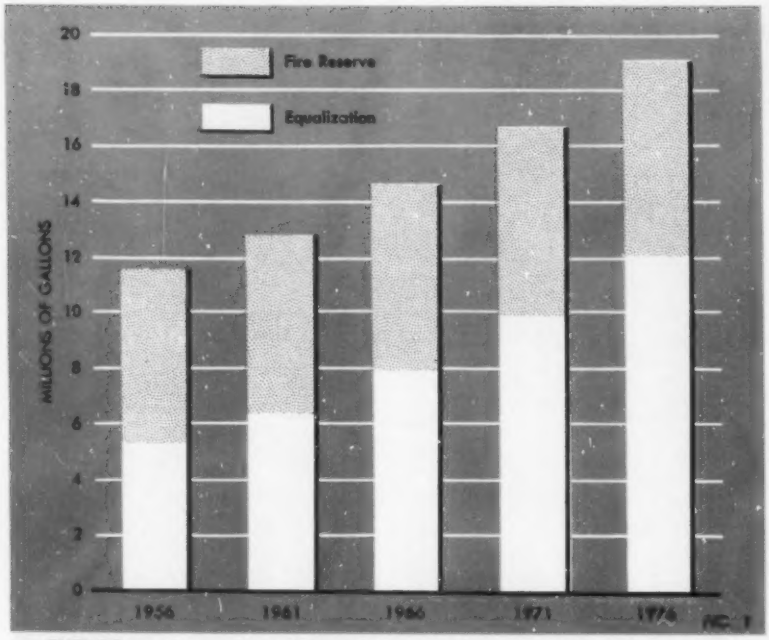
Improvements are to be made over the next 11 years, with the greatest expenditure now. The total for the present program, $6,573,941, will be spent for a treatment plant ($3,823,858), finished water storage ($696,600), improvement to the distribution system ($1,972.482), and lateral mains ($81,000). In 1961-62, another $81,000 is recommended for further extension of lateral mains. In 1966, proposed expenditures will amount to $104,760, covering more lateral mains and additional storage. It is contemplated that a new treatment plant costing $2,570,000 will be needed in 1968. Thus, the proposed program contemplates the necessity for spending $9,330,000 to safeguard the water future of Columbia.

Two important rivers, the Broad and Saluda, join just above the Gervais Street bridge to form the Congaree. The two tributary streams have distinct and differing characteristics. The Broad comes down from the north carrying so much sand and silt that efforts to use its water have resulted in silting up pipes and conduits, and in reducing the effective output of pumps.

The Saluda, coming in from the west and north, shows the effects of dams on turbidity and silt suspension. About twelve miles west of Columbia, the South Carolina Electric & Gas Company has a dam across the Saluda River forming Lake Murray, which has a surface area of 76 sq. mi. Still farther away, about 60 miles from Columbia, there is another dam forming Lake Greenwood.

Saluda River Supply

Comparing the two rivers, the Broad has a turbidity of 50 to 600 ppm, while the Saluda has 15 to 100 ppm. While the Saluda flows



● **FUTURE water storage requirements for equalization and fire reserve are plotted on the basis of a combination of both the Columbia and Eau Claire water systems.**

more rapidly, coming down from higher ground, and thus is able to carry more sediment in suspension, its clarity is chiefly due to settling out in the impounded lakes, particularly Lake Murray.

Broad River runs alongside the water plant. Its minimum flow averages nearly 3 1/3 times that of the Saluda, and its drainage area is almost twice as large—4,850 square miles against 2,510—and thus catches more rainfall. Its dependable supply, without storage will meet Columbia's needs, whereas the Saluda can supply only 48 mgd from river flow alone; 60 mgd with a low dam and 120 mgd with a high dam to provide for dry weather low flows.

The lower silt content in the Saluda reduces the cost of settling basins and treatment. Pumps are not damaged by abrasion and clogging, and a higher efficiency is realized in all plant processes.

Exhaustive measurements of river flow, and studies of the Lake Murray hydro-electric operational procedure, show that the Saluda can be relied upon to supply 48 mgd with no impounded reserve. Also, there are two pools in which a reserve can be impounded below the Lake Murray dam. The upper pool, with no river flow, has a reserve supply of 30 mg. A 6-foot dam at this point—estimated cost $60,000—would increase this reserve by 50 mg, assuring a total no-river flow reserve of 80 mg.

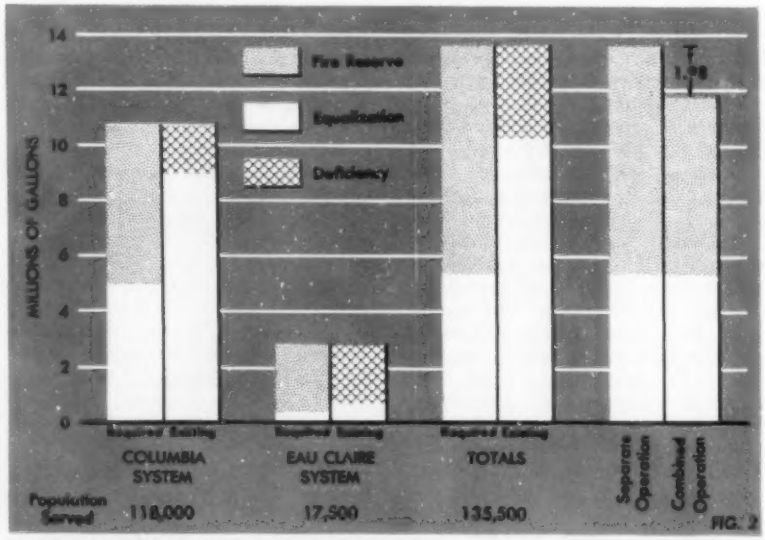
At the lower pool, the old Saluda Mill site, a 25-foot dam—to cost $490,000—would impound 3,000 million gallons, or 60 mgd for 50 days. The flow from the upper pool would be gated through the low dam to maintain reserves in both pools. With both pools dammed the city would be sure of 120 mgd, if the draw-down included river flow and impounding, or twice the maximum daily demand for 1986.

Lake Murray was considered as a source of water, "but the great cost of approximately 55,000 feet of 60-inch gravity main would make the use of this water extremely uneconomical." Nothing could illustrate the wide range of perspective across the country more conclusively than this statement. Columbia is highly favored, as compared with sections which talk about pumping de-salted sea water for 500 miles.

The study justifies the conclusion of the engineers that the lower-total-cost supply from the Saluda should be used. The new pumping station will have a net ultimate capacity of 60 mgd, to complement the ultimate possible net capacity of the same volume in the existing treatment plant. It will finally have five pumping units, with only three of these installed at the beginning, to supply 48 mgd. The force main to the treatment plant will be 48 in. to handle 60 mgd. An auxiliary supply will be kept available for the present in the Broad River Canal, with a line to supply 54 mgd. At present the supply is only 28 mgd.

Other considerations provide for cleaning the present raw water storage basin, and protecting the walls with rip-rap. No provision is made for dual diesel drives, as in most plants. There is a two-way electric power loop close to the present station, and only 2,600 feet from the plant site on the lower pool, running immediately adjacent to a plant site on the upper pool. Only a complete failure of the power plant would shut down the water system.

A second treatment plant, for future needs, would be built near the



● **COMPARISON of storage requirements for two water systems operated separately and in combination. Note the saving in storage requirements amount to 1.98 million gallons if the two systems are combined. The estimated saving in cost is $380,000.**

new pumping station on the upper or lower pool, and that choice has not yet been made. That will mean 100 percent use of Saluda River water.

Coagulation and Sedimentation

The existing equipment consists of two accelerated clarification units, a conventional clarifier, with a rapid mixer and flocculation unit and three settling basins.

The rate of flow of raw water to the clarifiers is controlled by manual rate-set devices, with an over-riding master control on all units to maintain a constant level in the clarified water distribution flume. Each unit controller regulates the chemical feeders.

The prime recommendation is to add conventional type clarifiers as the demand rises. Larger units should be installed, to require fewer chemical feeders, gas feeders, rate controls, and less piping.

An addition to the chemical building must be built, together with two flocculation units 60 ft. x 60 ft., and three 6-mgd settling basins, along with a flocculated water influent flume and a settled water transmission line. One chlorinator and three dry chemical feeders are recommended, with automatic controls, alarms, and supervisory instruments.

These additions, supplying 18 mgd, will bring the plant total capacity up to 42 mgd. Future expansion, adding 18 mgd more, will provide a total capacity of 60 mgd, the objective in mind.

Cost of the expansion to 42 mgd is estimated at $984,570, including engineering and administration. The second step, raising the capacity to 60 mgd, will cost $508,985, including engineering and administration. The total is nearly $1.5 million.

Filtration

There are eighteen 1-mgd filters in one building, and 6 1½-mgd units in an adjoining building. After filtration the water is treated with lime, and, when necessary, with chlorine. Provision is also made for fluoride addition. Wash water is lifted by two automatically operated vertical pumps. The engineers' only recommendation for this part of the plant was to add twelve 1½-mgd filter units immediately. The second step calls for additional units, to reach a design capacity of 54 mgd. To reach the ultimate of 63 mgd, the rates of the filters will be set above the standard 2 gpm per square foot of filter area.

The cost of putting existing filters in top condition, a new building, piping, equipment and accessory items is $1,027,242, which includes engineering and administration. To go on up to 63 mgd an additional sum of $448,565 will be spent.

The major clear water storage are adequate for an ultimate units capacity of 63 mgd, but specific and detailed recommendations have been made for larger piping and connections. The only tight place is in the clearwell storage reserve, and when the demand goes beyond 45 mgd it will be cheaper to build more elevated storage on the distribution system.

To bring this section up to 42 mgd capacity, about $160,000 will be required, and to get up to 63 mgd the cost will be $419,600 more.

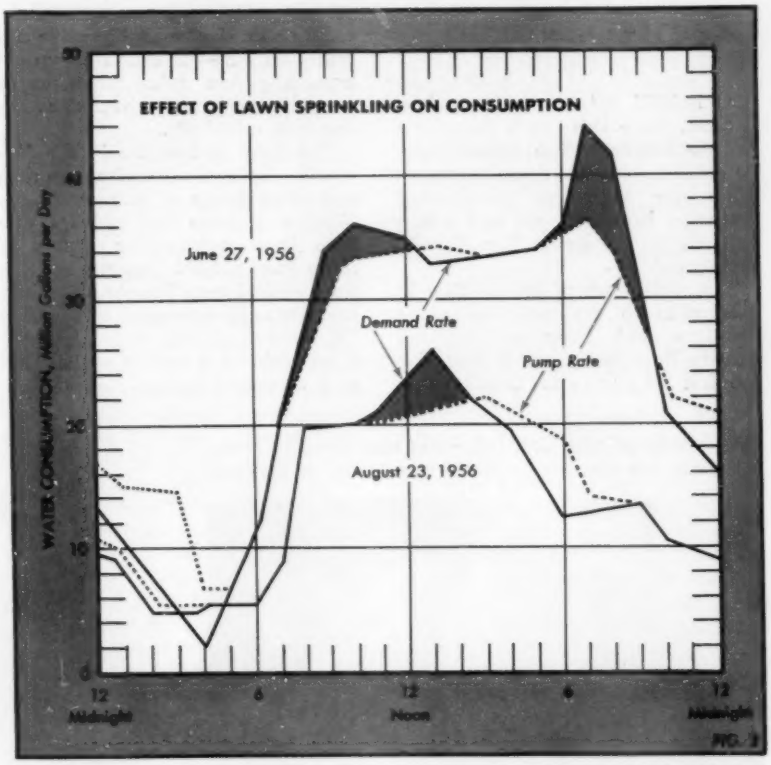
Distribution System Storage

The total ground storage capacity for Columbia and adjoining Eau Claire is 6.9 million gallons, 6 mg of which are in Columbia. The elevated storage total capacity is 3.385 mg, 3 mg of which are in Columbia.

The amount of water stored for equalization varies from 10 percent to 25 percent of the maximum day from one city to another. In Columbia it is 19 percent at present. The peak day pumpage in 1956 was just over 26 mg, and this times 19 percent is roughly 5 mg. The Underwriters' requirement based on population, excluding Eau Claire, is reserve storage of 5.88 mg equal to 9,800 gpm for a 10-hour duration. Considering the 10.88 mg total required for Columbia—5 mg for equalization plus 5.88 mg for fire—there is a deficiency of 1.88 mg. By the same method of reckoning the deficiency in Eau Claire is 1.515 mg. Storage requirements for the two cities combined are shown graphically in Figure 1 in 5-year increments to 1976.

For more storage capacity it is proposed to erect two 4-mg standpipes. In these 1.5 mg will remain above the minimum elevation of 415 ft. Each standpipe will have piping to a booster pump installed on one of them, to pump water from below the 415-foot level into the distribution system. This will add about 5.5 mg net to the storage,

(Continued on page 243)



● **WATER records for two summer days give contrasting pictures and show the influence of water use for lawn sprinkling. June 27 was hot and dry, preceded by six days of 100° plus temperatures, with no rain. August 23 had a maximum temperature of 87° and followed two cool days in which 3/4-in. of rain fell, which eliminated the early-evening sprinkler load. Besides, air conditioning use was below maximum.**

THE COUNTY SURVEYOR--*Then and Now*

GUY E. NEEPER, P. E.

Lucas County Engineer,

Toledo, Ohio

TO MANY old timers in modern Ohio, there is no such thing as a County Engineer. The elected public official who has direct responsibility for highways, roads and drainage, bridges, plats and plans frequently is called "The County Surveyor."

The persistence of the old title in preference to the more aptly-descriptive and statutory title of County Engineer is not strange. For the first 133 years after Ohio became a state in 1802, the official legal title was County Surveyor.

Even when the State legislature changed this to the present one of County Engineer in 1935, the law provided, and still provides, that whoever holds the post must be both a registered professional engineer and a registered surveyor. The salary or fees of the office still is based on old surveying terms, thus: "He (the county engineer) shall be entitled to charge and receive the following fees—for each rod run not exceeding one mile, three-fourths cent; for each rod run over one mile, one-half cent," etc.

The point is that the Public Engineer charged with the planning and construction or care and maintenance of roads and drainage systems in a metropolitan county of more than 500,000 persons, such as the Toledo-Lucas County area, finds his duty to be dominated by the term "Surveyor" in all of its implications both as a matter of law and as a matter of history.

But the modern job of County Surveyor is no longer a "one-man job". In Lucas County we regularly employ four full survey crews under the overall supervision of Charles Mayers, variously called Chief of Party, or Chief Surveyor, who has followed his profession since 1916 with a brief interruption for military service during World War I. He has been a county surveyor since 1933 and chief surveyor since 1946.

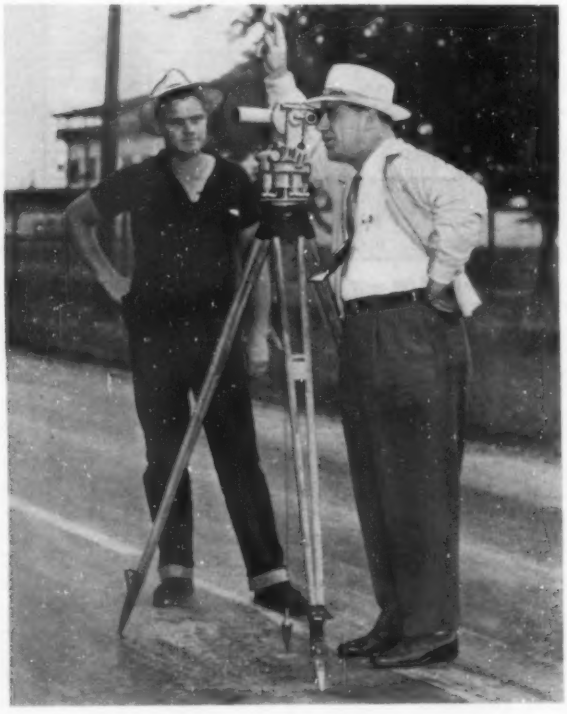
Each crew comprises a registered surveyor, an instrument man and two rod men. Sometimes a surveyor-in-training assists, but normally the crews consist of four members and the entire work force is directed by Chief Surveyor Mayers.

Equipment For Survey Force

Standard equipment for the survey force are the requisite number of station wagons, locally adapted for the purpose. We use one universal Theodolite, with 7½-inch telescope and a magnification of 28 diameters; three 18-inch Dumpy engineer's levels with 9¼-inch scopes, several Wye levels, four 6¼-inch highway transits, and the usual assortment of allied instruments or tools.

In 1954, we found by experiment that we could speed up our work

● **AUTHOR at right, with Instrument Man Meredith Freels, relocating lost northern border of historic city of Maumee.**



● **MODERN adaptation of walkie-talkie two-way radio is used by Lucas County survey personnel to speed up their work.**

considerably, particularly in bad weather or high winds, by equipping our crews with the modern adaptations of the army-marine "Walkie-Talkie", the light, two-way radio, transmitter-receivers to eliminate the margin for error in taking readings and depending on hand signals. By the same token, we have followed up on suggestions for other field aids and recently purchased a battery-powered loud speaker about half the size of the average cheer leader's microphone.

Construction Activities

The County survey force is a fixed unit of our regular payroll, although the balance of our labor force varies seasonally. Since 1950 we have completed construction or reconstruction of more than 52 county roads; have supervised installation of streets and drainage in 136 new subdivisions; replaced hazardous old bridges with 23 culverts; completed 45 storm sewers known as "enclosed county ditches"; built six road bridges; installed five flasher-signal grade crossing protective devices; and erected a quarter-million dollars of guard rails—the entire program outlay aggregating over $12,000,000 in addition to our annual maintenance program which now costs close to $1,000,000 a year.

The crews have performed their customary functions in the planning and performance of all of this work. While the road funds of this county normally would not cover such an expanded construction program, we have found that the State and Federal governments have been unusually cooperative in regard to the federal aid secondary program. In this respect, approximately $5,000,000 of our construction projects, including the first four-lane divided highway ever to be built on the county road system here, have been accomplished on the basis of 50 percent federal aid grants.

The survey crews have been hard pressed to perform the necessary and traditional functions of the surveyor with a program of this scope. But the routine work on road planning, sewer and ditch construction, bridge and overpass projects has been hampered to some extent by certain historical considerations which prevail. It has been said authoritatively that Ohio has more systems of land surveys than any other state. (Vol. III, Ohio Land Subdivisions, Final Report, 1925, Ohio Cooperative Topographic Survey, Sherman, C. E.) The same authority described this state as the "meeting place of the east and west, as far as land subdivisions are concerned." The National Rectangular System, prevalent in the west, and what often has been called "the indiscriminate system", prevailing in the eastern states, have their meeting point in Ohio. This state is known as the "experimental or testing ground" of modern surveying.

Old Maps Cause Doubt

While this distinction may be one of some interest to historians, the underlying reasons for it have resulted in a continuing problem for surveyors, particularly in this part of northwestern Ohio. The Toledo area a century or so ago was the scene of the so-called Ohio-Michigan Border War or the "Toledo War". It has been said that their boundary dispute arose because of the general misconception as to where the southern end of Lake Michigan lay in relation to the mouth of the Maumee River, or Maumee Bay, on Lake Erie. French cartographers mapped this country as early as 1690 and some of their maps, such as those of de'Lisle, (1703), Bellin, (1744) and d'Anville, (1746) reportedly were copied freely by later Colonial British surveyors and map makers who worked in the area in about 1755.

It was not until 1916 that the difference between border dwellers in these two states were finally determined by the completion of a joint survey and erection of a monumented boundary line by commissioners appointed by the legislatures of the respective states.

Lucas county and its neighboring area were subdivided by the U. S. Government surveyors in 1819-20-21 and the First Principal Meridian of the national system was established along the astronomical principles first suggested in this country by Thomas Jefferson, when he was governor of Virginia between 1779-81 and later followed by Rufus Putnam, Thomas Hutchins and Jared Mansfield whose work in the late 18th and early 19th centuries was the forerunner of the subsequent meridians and bases.

National Rectangular System

A substantial part of this county follows the National rectangular system, but the balance of it is broken up by Indian grants and other special parcels created by the treaties of Greenville in 1795, and subsequent treaties negotiated between that date and 1818. The Greenville treaty set up the reserve still known as the Twelve-Mile Square surrounding Fort Miami at the foot of the Rapids of the Maumee River. This area was laid out by Elias Glover in 1805 and still forms a prominent part of today's surveying problems.

The United States Congress, in 1807 validated the claims of early settlers by a series of private grants setting off a large number of tracts, most of which bisect the original squares of the Twelve-Mile Square in mile-long rectangles laid out by metes and bounds. Other Indian treaty land grants still cause some confusion for the survey crews.

Finding A "Lost" Border

An example of the type of problem that has faced our surveyors in the past was the recent incident in which the city of Maumee, oldest municipality in the county, "lost" its northern border and had to call on the County Engineer to find it.

Maumee is the site of Fort Miami, in the heart of the Twelve-Mile Reserve and its area also includes a majority of the old settlers' grants. Maumee grew from a village into a city almost overnight and has continued to grow since the 1950 census. As more and more homes were built in the missing northern border area, the taxing authorities encountered puzzling problems since the city tax rate was considerably higher than that of the township on the other side of the missing border.

In some cases, the county government could not determine which rates to apply, because they could not tell which side of the line some of the homes were on. The County Engineer in 1954, had to run a new survey of the three-mile long border to resolve the question once and for all.

Our survey crews frequently have encountered cases of lost "corners" and missing quarter section markers that must be reestablished. Ohio law decrees that these functions can be performed legally only by the County Engineer in his old role of County Surveyor.

When the crews are not occupied in making surveys for new paving projects, digging up control points, taking elevations or setting stakes, they are kept busy making records of and references to the established landmarks and gradually are reestablishing the bench marks for the entire county and placing semi-precise levels.

At other times, the survey crews lend assistance to the Toledo Metropolitan Park Board which has established several thousand acres of scenic woodland as public parks throughout the county.

REFUSE COLLECTION

● **ONE OF THREE refuse collection units recently purchased by Lynchburg, Va. Increased capacity (20 cu. yds.) has reduced number of trips to disposal point.**

THIS SURVEY of refuse collection equipment covers 35 typical cities with populations ranging from that of Charlotte, N. C., (134,000) to Lorain, O., (51,000), the populations being as reported for the 1950 census. Average population was 71,500; and 390 packer-type refuse collection units were in use, an average of 13 per city, or 18 per 100,000 population. However, usage was far from uniform, ranging from 33.7 units per 100,000 to 3.0, with a mean of 16.7.

Not all cities reported all sizes in use, but of 279 units for which capacities were stated, 49 were 20-yd.; 120 were 16-yd.; 41 were 15-yd.; 19 were 13-yd.; 19 were 12-yd.; and 31 were 10-yd. or less. Six cities report using 20-yd. packers and 20 use 16-yd.

The information in this article supplements data on the economies and practices of refuse collection with packer-type vehicles which were published in the January, 1958, issue of PUBLIC WORKS. In the January article only cities of more than 100,000 population were considered; the material which follows covers, in general, places below that size.

Savings by Using Packer-Type Trucks

Personnel requirements were reduced from four men to two men per collection unit by the use of packer-type trucks in Santa Monica, Calif. A crew now consists of a driver and one man. The city operates 15 packers of 20 and 16-yd. capacity, finding the latter more maneuverable.

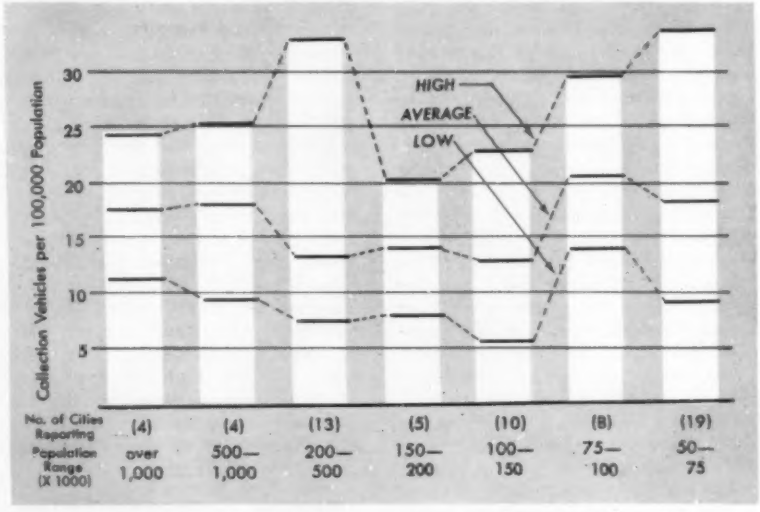
Cost figures on maintenance and operation, reported by C. C. Fagerlind for Waterloo, Iowa, indicates that the savings through the use of packer trucks amount to about $7.50 per day per collection unit and crew. A crew consists of a driver and two loaders; pickups are from alleys and in the rear of houses.

Brockton, Mass., reports through Daniel Cesarini that the estimated daily saving in cost for packer-type trucks is $10 as compared to open trucks; and, in addition, only three men per truck are needed as compared to four on open units. Collection is from the curb and a crew is three men. Quincy, Mass., A. A. Igo, Sup't., states that one packer-type truck can do the work of three open trucks.

Bay City, Mich., uses open trucks with specially built bodies—not packer type. These carry about 8 cu. yds. They cost less initially and provide a saving due to the short haul; but from a sanitary viewpoint they are not as satisfactory as closed bodies, particularly during a high wind. Jackson, Miss., also finds the open steel cargo type bodies satisfactory. These are 7x12x24, with extension of 4 ft. around the side.

In Hamilton, O., R. J. Fiemeyer estimates the savings from packer-type trucks are about 30 percent. The city has twelve 12-yd. units; the crew consists of a driver and two loaders. In Lorain, O., Alvin Conrad estimates the saving 25 percent on personnel and 50 percent on time and operation cost. Lorain has seven units—9, 12 and 13-yd. which operate with a crew of a driver and two "pickers."

A saving of approximately $5 per day through the use of packer-type trucks is estimated by R. M. Schaffner for York, Pa. This city operates ten 15-yd. units, each with a 3-man crew. J. D. Huffines of Wichita Falls, Tex., estimates savings from



● **PACKER-TYPE collection vehicle ownership, related to population of 63 cities.**

the use of packer-type trucks in that city at about 25 percent. There are eight 16 and 20-yd. units in service. With a 3-man crew, the 20-yd. packer makes about 640 pickups per day covering a 6½-mile route.

Alexandria, Va., R. S. Mangum, reporting, estimates a saving of $3600 per truck per year from the use of packer-type trucks, since these can cover twice the route per truck. For alley collections, a driver and 2 men are used; for front collections, involving "set out and set back," a driver and four men are used. Alexandria has 12 units, 9 to 20-yd. capacity. A saving of about 50 percent is estimated for Green Bay, Wisc., by F. J. Euclide. The ten packer-type units are 16-yd. and operate with a 4-man crew.

C. R. Nicolazzo, reporting for Kenosha, Wisc., says: "Packer-type collectors are more economical to operate. It is necessary to make fewer trips . . . and, when properly operated, they are capable of handling 2 to 2½ tons, which is greater than the load any of our other trucks could possibly handle and still make only one trip to the job in the morning, be back at noon for lunch and make another trip in the afternoon." Further comment by Mr. Nicolazzo is given in another article. Kenosha has five 16-yd. units; collections are from back doors and alleys; there are two men in a crew.

Racine, Wis., Henry A. Nelson, says: "No figures are recorded as to estimated savings . . . but there are several reasons why we prefer packer-type trucks. They (1) collect more material per load; (2) make fewer trips to the unloading station; (3) are easier to load; and (4) prevent blowing dust and spillage and eliminate unsightly hauling."

Vehicle Cleaning Practices

In Fresno, Calif., Ralph Tocchini, Supt., Waste Disposal Division, trucks are washed daily, using soap, and are treated with insecticide. Glendale, Calif., Wm. L. O. Martini, City Engineer and Street Supt., is planning a wash rack to provide better for daily cleaning. Oakland, Calif., Edward A. Tuchsen, Sanitation Supt., reports that the trucks of the Oakland Scavenger Co. used on dry garbage and refuse are cleaned with water while wet garbage or swill trucks are steam cleaned. San Bernardino, Calif., Raymond O. Powers, Supt., Refuse Disposal, also steam cleans.

John Szymansky, Supt. of Disposal, New Britain, Conn., uses water hosing for cleaning. Orlando, Fla., J. B. Shearouse, Sanitary Supt., washes trucks using a creosote disinfectant solution, but does not employ an insecticide. Macon, Ga., J. C. Hardy, Supt., Public Works Dept., uses a fire hose for washing. Edwin Smedberg, Supt. of Streets, Evanston, Ill., reports using soap and water, but Cedar Rapids, Ia., Dr. Carl D. Smith, Ass't. Health Officer, uses only clear water. Waterloo, Ia., C. C. Fagerlind, Street Commissioner, uses a high pressure water jet and has not felt the need for either odor or pest control; however pest control is employed at the disposal area in the summer.

Brockton, Mass., Daniel Cesarini, Executive Officer, Board of Health, uses hot water for cleaning trucks; an exterminator treats the trucks when necessary. Quincy, Mass., A. A. Igo, Supt. of Highways and Sanitation, employs steam cleaning. Bay City, Mich., R. K. McGillivray, Director of Public Works, uses only water for cleaning. Schenectady, N. Y., C. J. Leonard, Supt., Waste Division, washes trucks inside and out weekly. New Rochelle, N. Y., A. C. Mauro, Sup't., Refuse Collection, washes with a hose but uses a spray disinfectant in the summer.

Romeo F. Dusseault, Highway Surveyor, Manchester, N. H., reports use of steam for cleaning. Trucks are washed twice weekly in Jackson, Miss., H. B. Milstead, Sup't., Sanitation Dep't. A detergent and hose washing are used to clean trucks in Springfield, Mo., W. R. Miller, Ass't., Director of Public Works. Charlotte, N. C., O. C. Fogus, Sup't. of Motor Transport, uses water pressure with an automatic soap dispenser for washing trucks; chemicals and/or insecticides are used only under unusual conditions. Greensboro, N. C., V. L. Blaylock, Sup't. of Sanitation, washes the trucks but does not use any chemicals or insecticides. Winston-Salem, N. C., R. W. Neilson, Director of Public Works, hoses its trucks and uses odor masking or odor control chemicals to a limited extent.

Hamilton, O., R. J. Fiemeyer, Director of Public Works, uses steam and water for cleaning. Lorain, O., Alvin Conrad, Sup't., Division of Sanitation, washes trucks daily and uses insecticide daily for seven months each year. Altoona, Pa., George Sessler, Sup't. of Streets, washes with truck soap and uses odor masking and/or control materials.

Water is used for cleaning trucks in York, Pa., Ralph M. Schaffner, Dir. of Streets & Public Improvements, but odor control chemicals are used "sometimes" and insecticides "occasionally". Water only is used in Waco, Tex., Tom Howze, Sanitation Sup't. J. D. Huffines, Director of Sanitation, Wichita Falls, Tex., uses chemicals for odor control. Alexandria, Va., R. S. Mangum, Sanitation & Service Engineer, washes with water but uses no chemicals. Green Bay, Wisc., F. J. Euclide, Engineer - Superintendent, washes its trucks daily, steam cleans monthly and uses odor control

(*Continued on page* 170)

METHODS and EQUIPMENT

● **FLEET of eleven 16-yd. vehicles serves 85,000 residents of Cedar Rapids, Iowa.**

EXPERIENCE GAINED ON 65

PRESTRESSED CONCRETE BRIDGES

I. O. JAHLSTROM,

Principal Bridge Engineer-Operations,

California Division of Highways

FOR SEVERAL years after constructing an initial prestressed concrete bridge in 1951, California proceeded rather slowly in the use of prestressed concrete design. By 1955 four bridges had been built, nine more were completed that year, sixteen were built in 1956, 36 will be completed in 1957. There have been 13 channel, 19 T, 6 I, 28 slab and 3 box girder type of section prestressed bridges built with 5 miscellaneous type bridges.

The need for knowledge in design and for experience in construction required a slow and cautious approach to the use of prestressed designs. It was necessary also to know if contractors would be willing to bid on prestressed designs since it was a type of work and procedure totally unfamiliar to them and thus they had no background of experience or cost records on which they could base their bids.

It is interesting to note that the builder of our first prestressed bridge was a building contractor. Since then the bridge contractors have accepted the challenge on the new type of construction and they have done a highly commendable job. To date upward of 40 contractors have had direct experience in construction of prestressed bridges. We were not sure ourselves what the problems were and how to meet them, but by working and cooperating with the contractors and fabricating plants we are gaining experience and increasing our knowledge of prestressing with each job.

Off Site Fabrication

Commercial concrete products plants, seeing the possibilities in prestressed concrete, provided prestressing facilities and organized separate prestressed concrete plant organizations to study and promote the use of prestressed concrete.

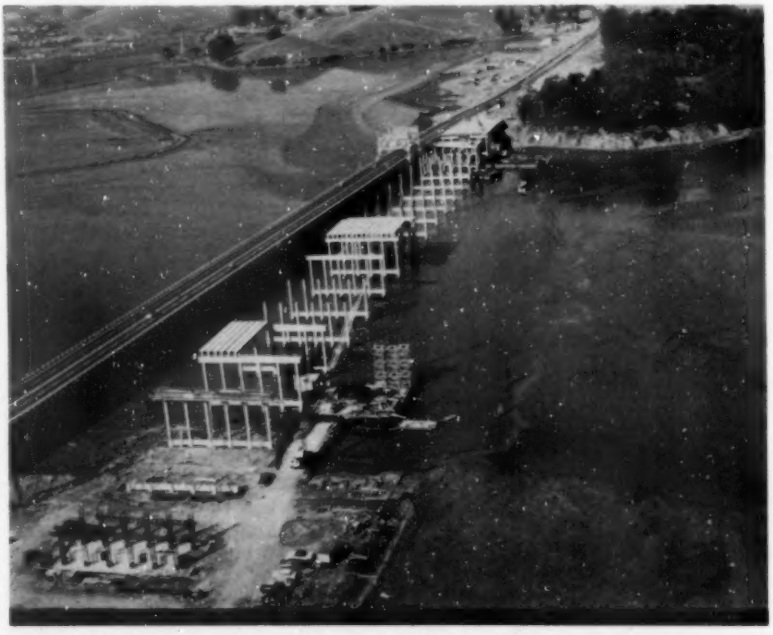
Our first precast prestressed bridge fabricated at a commercial plant was erected in 1955. This was a single 44-ft. span composed of 18 channel sections. The channel units were 2-ft. deep, 3-ft. 4-ins. wide, weighed approximately 16 tons, and were truck hauled 225 miles to the job site.

Since 1955 about half of our prestressed bridges have been fabricated at commercial plants and hauled by truck or railway or barged by water to the bridge site.

To date nearly all of the commercial plant fabrication has been done at two plants in the San Francisco Bay area, and volume has been about equally divided between the two plants. These plants have turned out I, T, channel (slab girder) and cored slab units and pretensioned piles.

Our two largest precast prestressed bridges are the Richardson Bay and Eureka Slough structures. On the Richardson Bay Bridge 270 80-ft. precast T-sections were used. These were hauled by barge to the bridge site and picked up direct from the barge. The prestressed girders were used for the water portion of the bridge with conventional reinforced box girders on the land portion.

The 105-ft. T girders and the 30-ft. deck slab units for the Eureka Slough Bridge at Eureka were transported by barge 225 miles up the coast. The first attempt to barge the seven 105-ft. girders ended in dis-



● **CONSTRUCTION in progress on the Richardson Bay Bridge. The bents are supported on H piles driven to bedrock. Construction details are shown on facing page.**

aster when a heavy ground swell at the entrance to the harbor caused the load to shift and overturn the barge. New girders were cast and no further incident occurred barging the units by sea.

The following tabulation of the haul distance from plant to job site indicates it is neither too costly to haul precast sections from the central plants nor does it present much of a problem: Less than 100 mile haul 11 bridges; 100-200 mile haul 4; 200-350 mile haul 5; and 300-350 mile haul 8.

In addition to the prestressed concrete plants located in the San Francisco Bay area there are plants at San Diego, Los Angeles and Bakersfield; and other locations are under consideration. These plants have done bridge work for cities and counties and are furnishing the prestressed sections for several State projects.

Fabrication At Site

In slightly over half of our prestressed work the prestressing has been done at or near the bridge site by the contractor. On two multiple span bridges the contractors set up casting yards near the bridge site in an area that was relatively level and required little work to build a good casting bed and storage area for the girders.

On the Santa Clara River Bridge, a 23-span structure with 184 71-ft. T girders, the contractor cast 48 reinforced concrete beds the same size as the girder soffits. The beds were recessed 1⅝-ins. for 15-ins. at each end and filled with wooden plates to allow for removal of the plates when the girders were prestressed, otherwise the ends of the girders would spall, since the prestressing force humps or cambers the girder causing end bearing.

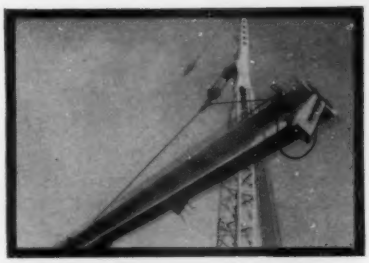
Six sets of wooden forms were constructed with ⅝-in. treated plywood used on exposed surfaces. Two girders were cast each day but toward the end of the job when the crews became more efficient, they were able to cast a maximum of 12 girders per 5-day week.

Santa Maria River Bridge, another large field job, was constructed in the same general manner. This bridge has 24 spans with 120 50-ft. T girders.

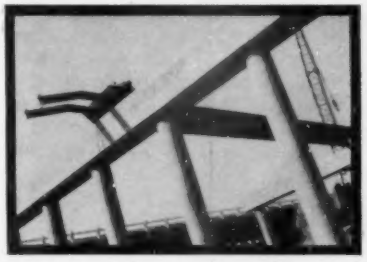
The prestressed box girder bridges have been poured and prestressed in place. The longest single span of this type that we have constructed is the 115-ft span, Big Dalton Wash Bridge, near Los Angeles.

The John Street Overcrossing in Salinas is a continuous structure with 98-ft. and 100-ft. spans. This was one of our earlier prestressed jobs and we had difficulty in grouting the wire enclosures or ducts. There were a number of reasons for this—the long length of duct, use of too much sand (1:3 mix), inexperience, and unsatisfactory equipment. The contractors are now using higher pressure equipment able to handle low w/c (0.40—0.45) grout.

The 36 72-ft. I units for the Limekiln Creek Bridge were transported



● **LONG, heavy precast girders require special handling techniques, as shown in these pictures. At top, 80-ft. T-section for the Richardson Bay Bridge is lifted up from the supporting barge.**



● **CARRIAGE mounted on steel girders spanning bents is ready to receive one end of the precast prestressed section.**

● **PRECAST T-section on carriage is moved into position. Barge crane holds left-hand end of the section as shown.**

● **COMPLETED bridge, picture taken 14 months after the one on the opposite page. View is to the north. A 2-inch bituminous surface has been placed as leveling course.**

● **FLAT SLAB over busy street. This bridge has a span of 62 ft. and a width of 100 ft.; depth 26 inches. Superstructure cost of this type bridge is about $7 per ft.**

by truck over 200 miles from the casting yard above San Francisco. The girders were skidded transversely from the deck of the old bridge to position and lowered on the caps. This bridge has a cast-in-place deck which has a point of superiority over a T section type, in that no plant mix leveling course is needed to obtain a smooth riding surface. Variations in elevation with the "I" girder can be taken care of in the fillets between deck slab and girder.

Another interesting early job was the 62-ft. span flat slab bridge at Bacon Street, San Francisco. This bridge is on the six-lane freeway leading south. It is 100 ft. wide and transverse as well as longitudinal prestressing was used.

In the same contract were two prestressed pedestrian over-crossing structures, at Harkness Avenue; a three-span continuous fla. slab of 40, 60 and 40-ft. spans continuously prestressed; and at Third Avenue a single span 70-ft. T-section with an eight foot sidewalk as the top flange of the T.

Design

Standard sections have been prepared by our Bridge Design Section for slab, slab girder, and "I" type precast prestressed units. Span length for the slab units are from 19 through 40 ft.; slab girder units from 30 through 60 ft.; and "I" girder units from 30 through 120 ft.

Bridge plans show the path of the center of gravity of the prestressing force. The required working force is also indicated. Up to the present we have not specified the type of prestressing steel, giving the contractor the option of using high tensile cold-drawn wire, high tensile cold-drawn wire strand or high tensile alloy bars. Wire or strand is specified to have an ultimate tensile strength of not less than 200,000 psi and alloy bars not less than 145,000 psi.

We now specify stress-relieved wire with an E of not less than 24,000,000 at 70 percent of the manufacturer's minimum guaranteed ultimate strength. Bars are required to be proof-stressed to at least 90 percent of the specified minimum tensile strength.

Detailed specifications on enclosures, prestressing steel, distribution plates and anchorages (post-tensioning), prestressing, and testing are covered in special provisions.

Prior to casting any members the contractor is required to submit to the State for approval complete details of the methods, materials, and equipment he proposes to use.

● **TENDONS are in place, prior to placing concrete, for the bridge over Bacon St., shown above. There are 18 wires in the longitudinal units, 12 in the transverse.**

Concrete Strength And Mix Design

Our conventional structural concrete, designed for a minimum strength of 3000 psi, is a standard six-sack mix with low alkali, Type II, cement specified. We have a wide range of concrete aggregates and, as would be expected, a rather large range in concrete strengths.

In our prestressed concrete we call for concrete having not less than six sacks of cement per cubic yard with a specified strength before prestressing. This ranges from 3500 to 5500 psi. For the higher strengths we have used up to an 8-sack mix.

At the commercial fabricating plants steam curing is generally used, thus shortening the time interval between casting and prestressing. The steam curing period averages around three to four days depending on weather conditions and air temperature and the type

● **PEDESTRIAN overcrossing at Harkness Ave. This continuous 3-span slab was cast in place and continuously prestressed. Width 9 ft.; spans 40-60-40 ft.; depth 13 ins.**

of steam enclosure equipment used. The steam temperature is held at 140°F with a maximum of 145°F permitted for a short time.

A typical mix is the following used on the Santa Clara River bridge:

Sand	35% by weight	1100 lbs.
¾" C.A.	65% "	2040
Cement	7.50 sacks	705
Admixture	1/4#/sack	1.875
Water	5.25 Gal/sack	329
Slump	2½" to 3"	
		4176#/c.y.

The average compressive strength, cylinder breaks, for this mix were: 10 days 4675 psi; 14 days 5205 psi; 21 days 5893 psi; and 38 days 6255 psi.

The concrete strength specified for this bridge was 5000 psi at 28 days and prestressing was permitted after 14 days.

The required strength usually is obtained in 2 to 3 weeks on job site fabrication and from two days to a week at commercial fabricating plants using steam curing.

Cost Data

A comparison of the cost of a prestressed design to a conventional concrete design will not give a fair or accurate evaluation unless all the factors involved are considered. Approach embankment costs can be compared. Quicker use of the structure involves direct and indirect savings. Elimination of hazardous falsework or centering where there is a heavy volume of traffic is a benefit which cannot be evaluated in dollars alone.

Where clearances, falsework, traffic, and other conditions are not governing factors, our bid prices show that a conventional concrete design is more economical than a prestressed design. With volume production of standardized precast prestressed units the differential in cost undoubtedly will become less. However it appears that for some years to come prices on conventional designs for normal structures will be lower than for prestressed designs.

The following is the cost per square foot on several bridges of prestressed construction in California: Slab type structures from 59 ft. 9 ins. to 62½ ft. in span ranged from $6.86 to $7.26 psf of superstructure and from $12.76 to $12.84 psf for the entire bridge; channel section type bridges from 34 ft. to 50 ft. in span cost from $5.76 to $8.62 psf for the superstructure and from $8.51 to $21.38 psf for both substructure and superstructure; "I" girders in spans from 44 ft. to 100 ft. were built from $6.00 to $9.77 psf of superstructure and from $9.54 to $18.32 psf for the entire bridge; "T" section units in spans from 50 ft. to 80 ft. cost $4.00 to $4.82 psf of superstructure and from $8.40 to $14.03 psf for the bridge; a box girder in spans of 93 and 100 ft. cost $7.67 psf of superstructure and $14.78 psf for the entire bridge.

A breakdown of costs for an 80-ft. prestressed girder as given by one large commercial plant was: Concrete $300; prestressing steel $400; bar reinforcing steel $250; miscellaneous items $100; labor, insurance, etc., $500 to $600; plant charge $250; manufacturer's markup $200; transportation $200; and forms very little cost to $300. Total cost ranged from $2300 to $2400.

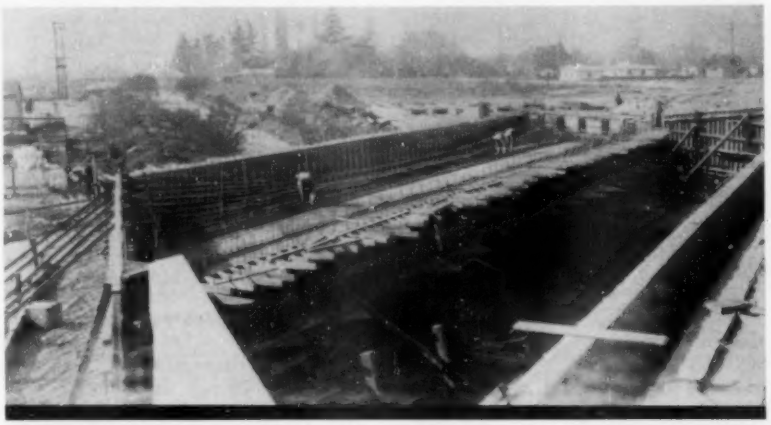
The average bid prices for furnishing 80-ft. precast prestressed girders on two jobs were: $2408 for 190 80-ft. T sections 4-ft. 4-ins. deep; and for 136 80-ft. T sections 3-ft. 10-ins. deep $2271. On the later job there were seven bidders and the bid price for this item ranged from $2000 to $2500.

On nearly all of our bridges the bid price for furnishing precast prestressed units has been within a comparatively narrow range which indicates a vigorous and healthy competition among the commercial fabricators.

Conventional Design. A true comparison cannot be made of the relative cost of a prestressed design and a conventional concrete design since even though bids are taken on alternative designs, only one design is built and estimated figures have to be used for the comparative cost of the alternative.

In the following paragraph the square foot costs for conventional concrete designs are not limiting figures for each type of design. A few representative bridges of each type were taken to show the general spread in costs.

(*Continued on page* 160)



● **LONGEST single span yet built by Highway Dep't. is this 115-ft. Big Dalton Wash Bridge near Los Angeles. Prestressing tendons for this box girder type are shown.**

● **GIRDERS for the 72-ft. Limekiln Creek Bridge were hauled by truck over 200 miles from San Francisco. This picture shows a method of unloading by use of jacks.**

SEWAGE PLANT FOR RESTAURANT TREATS 12,000 G.P.D.

A HIGH RATE trickling filter is utilized for treating the wastes from Manero's restaurant on New Jersey Route 17, some 20 miles out of New York City. The plant to treat a flow of 12,000 gallons per day, or 16.7 gpm, based on 12-hour operation, was designed by Alfred Crew, consulting engineer of Ridgewood, N. J., and is expected to produce an effluent with less than 30 ppm of BOD. The treated waste is discharged to a small brook.

The present seating capacity of the restaurant is 270, but it is expected that ultimately up to 1500 persons will be served daily. Allowing an average per capita contribution of 8 gallons per day, design was fixed at 12,000 gpd over a 12-hour period. Average raw BOD was 300 ppm.

Some treatment facilities were already in use and the design was based on utilization of these to the greatest extent possible. The facilities for sedimentation and grease removal included the following: A circular precast reinforced concrete tank of 1,000 gals. capacity to cool the scullery wastes and facilitate grease removal; an existing 2,000-gallon and three existing 500-gallon septic tanks which will continue to function as additional sedimentation tanks. Five precast concrete septic tanks were provided to complete the primary sedimentation facilities. These are 74 ins. in diameter with 56 ins. sidewater depth and a capacity of 1,000 gals. each. Planning the sludge capacity required working from a sewage volume basis, rather than per capita. Accordingly, 3 cu. ft. were allowed per 100 gals. of estimated sewage flow. The detention period is 2.3 hours and the surface settling rate is 170 gals. per sq. ft. per day.

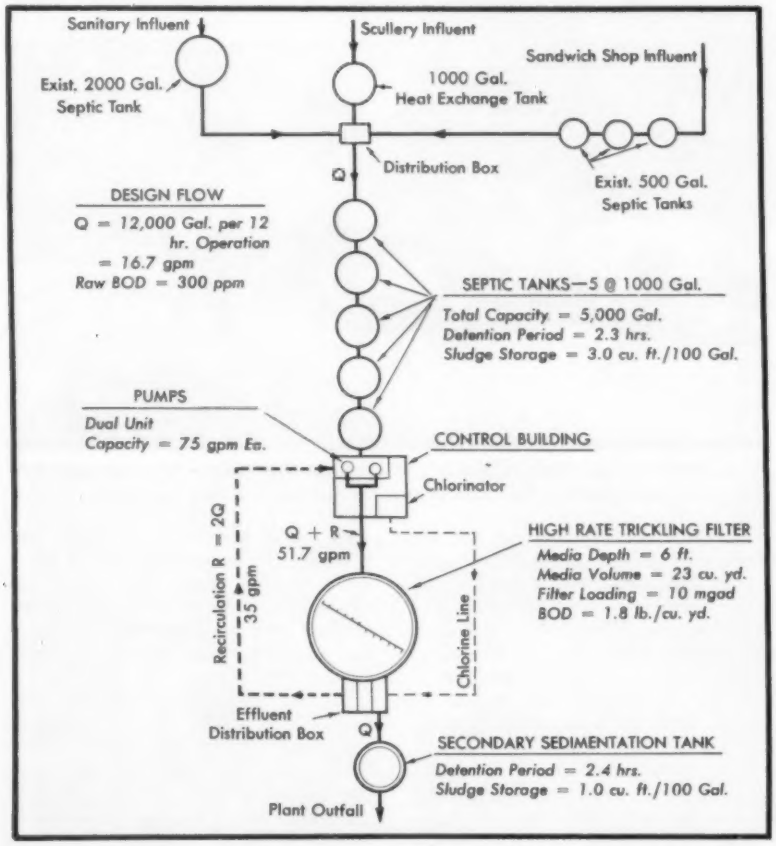
The primary effluent discharges to a wet well in which are housed duplicate submerged type centrifugal pumps with a capacity of 75 gpm each. The recirculated effluent from the trickling filter also enters this wet well; the recirculated volume varies from 33 gallons per minute (2 to 1 recirculation) at minimum flows to 50 gpm (3 to 1) at average flow conditions. The hydraulic loading on the filter will be 10 mgad.

The single stage high rate filter, which is equipped with a Carter distributor, is 12 ft. in diameter and 6 ft. deep, containing 23 cu. yds. of 2-in. to 4-in. stone. The loading for design is 1.8 pounds of BOD per cu. yard. Discharge is to a distribution box with V-notch weirs, which provide for recirculation of 33 to 50 gpm to the pump sump and discharge of the overflow to the secondary settling tank. The filter shell is of ¼-in. steel, painted and stiffened with angles. The underdrains are filter bottom blocks, and the unit is provided with vent blocks, vents and channel covers of vitrified clay.

The final settling tank is a modified Imhoff tank in principle, composed of 10-ft. diameter concrete pipe placed vertically end-to-end to provide an 11-ft. side water depth. The structure is equipped with an open cone-shaped steel settling compartment, 8 ft. in diameter, which provides 2.4 hours detention at 12,000 gals. at the 12-hr. operation rate. The surface area is 50 sq. ft., which provides a surface settling rate of 480 gals. per sq. ft. per day. Sludge storage is in excess of 2 cu. ft. per 100 gals. daily flow. Sludge removal is by pumping and final disposal into a sewer manhole or to a sanitary fill, as with septic tank sludge from residential installations.

Chlorination of the effluent is by a manually controlled hypochlorinator capable of feeding a 1 percent solution at the rate of 68 gallons or 5 pounds of chlorine per 24 hours. Application is to the trickling filter effluent, with contact in the secondary settling tank. The hypochlorinator is in the Control Building.

The estimated cost of this installation was $15,800. While normal plant operation is by restaurant employees, supervision by a licensed sewage plant operator is required by the State Department of Health.



● SCHEMATIC layout and design bases for the restaurant sewage treatment plant.

A NEW METHOD FOR FINANCING ORNAMENTAL STREET LIGHTING

W. W. COBURN,
Urban Renewal Planner
Ann Arbor, Michigan
formerly Administrative Assistant,
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HOW COULD we best satisfy the wishes of those residents who wanted ornamental street lights without putting the City in the street lighting business? That, in brief, was our problem and this article is a description of the way we solved it and saved our residents money in the process.

At present, the City of Grosse Pointe Woods has ornamental lights on eight streets. The lights on six of the eight were installed many years ago when those streets comprised the most attractive residential areas of the City and, supposedly at least, deserved something better than wood utility poles. The Detroit Edison Co. installed the lights and has continued to maintain them, operate them, and retain ownership of them just as it has the ordinary standard overhead type of lights that now illuminate the majority of streets in the community. For the ornamental lighting service the City pays a monthly charge which is somewhat higher than the rate for standard utilitarian equipment. All payments are made from the general fund. None of the property owners on the six streets has ever been assessed for any part of the cost.

Early in 1953 the property owners on two streets in a newly developed subdivision petitioned the City for installation of ornamental lights. In this case, however, the Council decided that the cost of the special equipment should be borne by the benefiting parties and a Special Assessment District was established with the home owners paying all but a very small percentage of the total cost in three annual installments. Special assessment bonds were sold, the equipment was purchased, and the installations were made by an electrical contractor. Thus, the City owns these lights outright and buys electrical power for them from the Detroit Edison Co. at the rate for municipally-owned ornamental equipment which is approximately the standard monthly overhead rate; however, repairs and maintenance are taken care of by Detroit Edison on a contract basis. The cost per installed light was $1,138. That, of course, does not include power and maintenance charges.

Present Problem

In the fall of 1956 the City began receiving inquiries from property owners in a number of new, unlighted subdivisions regarding the possibility of obtaining ornamental street lighting for their respective neighborhoods. Again it was the feeling of the Council that the benefiting parties, not the City at large, should pay for the special equipment —but not the entire cost. Since the City finances all standard street lighting out of the general fund, it was deemed no more than fair to require benefiting parties to pay *only the differential* in cost between ornamental equipment and the standard equipment which they would ordinarily receive for their tax dollars. At present rates for minimum size residential lighting, this differential amounts to $3 per light per month or $36 per light per year.

A second decision favored keeping the City out of the street lighting business. As mentioned previously, the Detroit Edison Co operates and maintains all lights in the City and owns all but those few financed by special assessment. Considering

● **TYPICAL of the new lighting system: 6,000-lumen incandescent lamp on 30-ft. steel pole with a 15-ft. bracket. Average contribution per lot was $167 to $199.**

these facts, along with the additional labor and equipment expenditures necessary for the City to install and maintain its own ornamental lighting system, it immediately became apparent that it would be more economical for the Detroit Edison Co. to make the installations, provide the maintenance, and retain ownership of the lights.

This, however, created a problem. Our City Attorney rendered an opinion that, according to the City Charter, no special assessment can be levied for the installation of equipment which the City will not own. In other words, a different method of financing would have to be found or the City would have to go into the street lighting business.

New Plan Conceived

After considerable discussion, a voluntary contribution plan was proposed as a possible solution. It called for a petition signed by a majority of the property owners in a given area (one or more streets, a subdivision, etc.) requesting installation of ornamental street lights of a specified type and financed by voluntary contributions from said property owners in an amount sufficient to cover the cost differential between standard and ornamental equipment for a period of thirty years—the average length of time determined to be the operative life of ornamental equipment.

The important point here is that the total voluntary contributions need not equal the total cost differential for the thirty years, thus resulting in considerable savings for the property owners involved. The advantage is, of course, that the contributions can be invested and the interest used to pay part of the cost differential. For example, at present rates the differential between a standard 2500-lumen street light on a wood pole with overhead wires and a 6000-lumen ornamental light on a steel pole with underground cable is $1,080 for thirty years; however, the property owners are required to contribute $895.74 of this sum. The remaining $184.26, multiplied by the number of lights installed, will be paid from interest accrued at the average annual rate of 2 percent. Obviously the rate will fluctuate over a span of three decades, but 2 percent was considered to be a conservative and safe average for computing the contribution needed for each light.

The thirty year depreciation period was established for financing purposes only. Whenever an ornamental light, regardless of age, has deteriorated to the extent that it can no longer function properly, the property owners benefiting therefrom must voluntarily provide funds for replacing said light. In the event an ornamental installation under this plan is replaced or modernized before a reasonable amortization of the system has been attained, the Company reserves the right to negotiate a temporary rate increase to cover the additional investment and the increase will be borne by the benefiting parties. In either case, if the home owners fail to contribute the necessary funds, the light will be replaced by the type of street light then being furnished to all residents at public expense.

Plan Adopted And Activated

Shortly after the voluntary contribution plan was first conceived, a meeting was held between officials of the City of Grosse Pointe Woods and Detroit Edison Co. representatives to find out if the latter would accept such a revolutionary idea. The Company representatives not only voiced no objections to the plan; they offered a number of helpful suggestions.

Every detail of the financing plan was checked by the City Auditors, Price, Waterhouse Co. of Detroit, and pronounced sound by them. The actuarial computations were made by the firm of A. G. Gabriel, also of Detroit, which serves as actuary for our municipal pension plan. The interest rate was based on the recommendations of both parties. Since the program will include only a segment of the total population, 10 percent was added to the initial computation to cover the cost of administration. A step-by-step procedure was formulated, after which the plan was formally presented for Council action. Following a minimum amount of study and discussion, the plan was adopted unanimously.

Since the entire procedure was initiated at the request of residents, it was a simple matter to find one person in each neighborhood willing to circulate the petition—to carry the ball, so to speak. All negotiations with the property owners are carried on only through these volunteer group representatives. Each is supplied with a copy of the proposed street lighting plan for his particular subdivision and a photograph of the type of equipment to be installed (both furnished by the Detroit Edison Co.), the policy resolution by the Council, a mimeographed letter from the Director of Public Safety listing ten important advantages of living on a well-lighted street and, of course, a petition form. We understand that some of the group representatives have recruited block leaders and other helpers, but the City does not deal directly with these people.

Progress To Date

As of this writing, the residents in one small subdivision involving two streets and five proposed ornamental lights have rejected the voluntary contribution plan and have indicated a willingness to accept standard lights. Prior to this decision, the lack of agreement as to the type of street lights desired prevented the installation of any. Those who favored ornamental poles and underground cables refused to grant rights-of-way for overhead lines above their property; consequently, the situation became stalemated. Although the voluntary contribution plan did not result in the installation of ornamental street lights in this particular subdivision, it was instrumental in breaking the deadlock and paving the way for standard lighting. Considering the fact that agreement could not be reached before, this is no small accomplishment.

At present, petitions are in the process of being circulated in four other subdivisions involving sections of 15 streets and 49 proposed ornamental lights. Representatives of the property owners in these areas appear to be optimistic about the outcome. As soon as the necessary signatures have been obtained and the total contributions have been deposited with the Treasurer, the City will request the Detroit Edison Co. to begin installation of the lights. The Company has given its assurance that said installations will be made as soon as the equipment and manpower become available.

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The Editor, PUBLIC WORKS, 200 South Broad St., Ridgewood, N. J.

Modern Municipal WATER SOFTENING PRACTICES

ESKEL NORDELL

This article is based on a paper presented at the 49th Annual Meeting of the Indiana Section, American Water Works Association in Indianapolis. Eskel Nordell is Director of Technical Information of The Permutit Company and the author of "Water Treatment for Industrial and Other Uses," Reinhold Publishing Corp., New York.

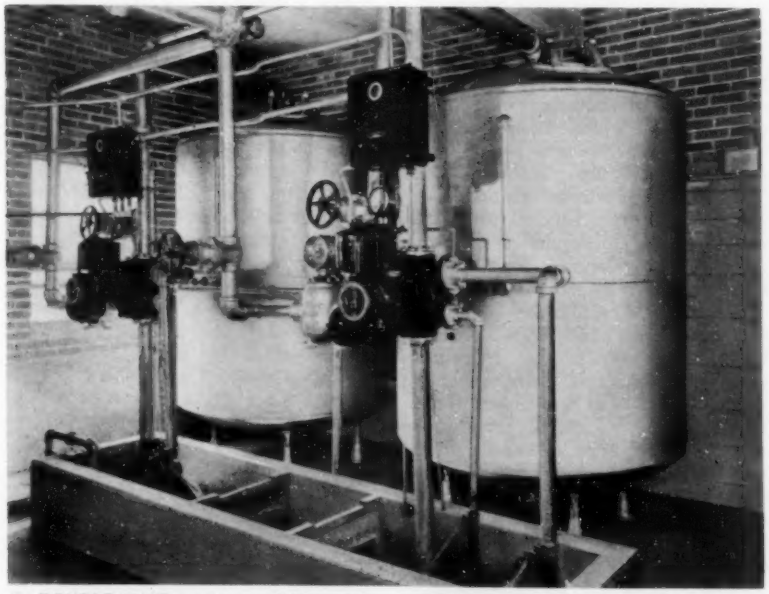
THE HARDNESS of a water is dependent on and proportional to its content of soluble compounds of lime and magnesia. For general municipal purposes, it is commonly accepted that this hardness should not be greater than 4 or 5 grains per gallon, expressed as calcium carbonate. This is equivalent to 68 to 85 parts per million.

Furthermore, if a water is harder than this, it is commonly considered that softening it to this point is sufficient. This benefits all the citizens, even those who have their own zeolite water softeners for they will get 4 times more water between regenerations. This softening to a 4 or 5 gpg residual is not inflexible, for some municipalities are content with a 6 or 7 gpg residual and others require a 2 to 3 gpg residual.

There are two distinct methods of softening municipal water supplies and a third, which is a combination of the other two methods. These are: 1) The zeolite (or sodium cation exchanger) process; 2) The lime or lime soda process; and 3) The combination lime zeolite process.

The Zeolite Process

In the zeolite process, one portion of the water is completely softened by passing it through zeolite water softener units and this is then mixed with enough of the hard water to give a mixed effluent of the desired composition. Strictly speaking, only the inorganic or mineral cation exchangers should be called "zeolites" but, due to long usage, this term has become so firmly entrenched that it is also used for the organic cation exchangers.



● **DOUBLE UNIT zeolite at Clifton, Kans., completely softens 200 gpm of 13 gpg hardness water; this is mixed with 50 gpm unsoftened water to yield 2½ gpg residual.**

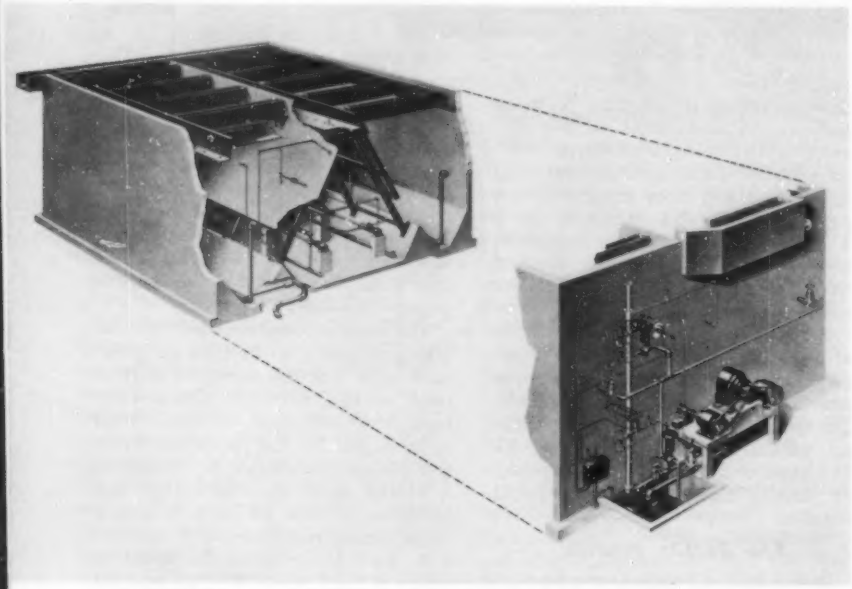
The zeolite water softener may be either of the gravity type or pressure type but the pressure type is most widely used. In the gravity type, the container or shell is an open tank. In the pressure type, the cation exchanger is placed in a closed shell. Depending on the hardness of the water and length of softening run, the depth may be 2 ft. to 7 ft. or more. In order to soften a hard water by this process all that is necessary is to direct the water downwardly through the zeolite bed. On coming into contact with the zeolite granules the calcium and magnesium cations are removed and held by the zeolite which gives up to the water an equivalent amount of sodium cations in exchange. The softening accomplished is practically complete. Therefore, if a 20-grain hardness water is to be softened to 5 grains, three-fourths of the water is softened by zeolite, and this is then mixed with one-fourth of the hard water.

When the water softening capacity of the zeolite bed is used up—4 to 8 hours or more—the softener unit is cut out of service and the zeolite is regenerated. This regeneration consists of three steps—backwashing, salting and rinsing. Backwashing is accomplished by passing a strong, upward flow of water to loosen, cleanse and hydraulically regrade the zeolite bed. Salting is carried out by flowing a predetermined volume of a solution of common salt through the zeolite

bed. When the salt solution comes in contact with the zeolite, it removes the accumulated calcium and magnesium and simultaneously restores the zeolite to its former active or sodium state. Rinsing, consists of washing the chlorides of calcium and magnesium, plus any excess of salt, out of the zeolite bed. After rinsing, the softener unit is restored to service ready to soften a further equal amount of the hard water. The total time required for these regeneration operations ranges from ¾ to 1½ hours.

slightly over ordinary temperature ranges, no correction for temperatures need be made for the saturated solution and volume measurements are satisfactory.

In seashore cities, filtered and cholorinated sea water may be used instead of commercial salt. When so regenerated, the capacity of the zeolite is about 40 to 60 percent of the capacity when regenerated with commercial salt so larger units and deeper beds are employed. Operating costs with this system are extremely low.



● **HORIZONTAL precipitator constructed of concrete, showing internal construction. Flow is downward through central compartment and upward through sides to top.**

These cycles of softening and regeneration may be repeated indefinitely as the wear and tear on a correctly processed or manufactured zeolite is very slight, being less than 3 percent per year. Therefore, annual additions of only a very small amount of zeolite are all that is required to keep the softener functioning at its original capacity.

Zeolite water softeners are usually installed in batteries of 2 or more units so that while one unit is being regenerated, the other unit or units will carry the full load. Units range from as small as 20 ins. in diameter with a flow rate of 1050 gph up to 10 feet in diameter with a flow rate of 37,800 gph. They are available in both manually operated and fully automatic types.

Most of the municipal zeolite water softening plants are regenerated with commercial salt which is shipped in bulk and stored in concrete wet salt storage basins. As the solubility of salt varies only

Due to their much higher capacities, higher flow rates, and lower salt consumptions, the new type of organic cation exchanger is rapidly displacing the older mineral zeolite. A standard greensand zeolite, for instance, has a capacity of only 2.8 kilograins of hardness removed per cubic foot with a salt consumption of 0.45 lb. per kilograin. A modern, high capacity, organic cation exchanger, such as Permutit Q, has a capacity of 20 kilograins per cubic foot with a salt consumption of only 0.275 lb. per kilograin. In other words, the water softening capacity of the new type of zeolite is 7 times as high as the capacity of the standard greensand type of zeolite. This means smaller equipment and/or longer softening runs. Also, since the salt consumption per kilograin of hardness removed is only 60 percent of what it was formerly, softening costs are correspondingly reduced. At prevailing prices for salt in bulk in carload lots f.o.b. Indiana destinations, the cost for salt per grain of hardness removed per 1000 gallons with the new type zeolites is only 0.2 cent. In other words, a 15 gpg hardness water can be softened to 5 gpg at a cost for salt of only two cents per thousand gallons. The salt savings in waters of greater hardness are proportionally higher.

While the capacity of the new types of zeolites is 20 kilograins per cubic foot, when regenerated with 0.275 lb. of salt per cubic foot, as compared with greensand's 2.8 kilograins even with 0.45 lb. of salt, the greensand zeolite requires somewhat less rising space than the new type zeolites. Therefore, if the greensand zeolite in a water softener unit were replaced with a new type zeolite, the capacity would not be 7.1 times as great because not quite so many cubic feet would be used; actually the water softening capacity would be 5.2 times as great. Also, since the operating flow rate is higher (8 gpm/sq. ft. as compared with 5 gpm/sq. ft.), the speed at which the softener units could be operated would be much greater.

These new types of zeolites are not injured by chlorinated water so dechlorinating equipment does not have to be installed ahead of them, when operating on a chlorinated water, as was the case with some of the earlier high capacity cation exchangers. These zeolites may also be used on iron or manganese bearing waters for removing these metals as well as the hardness.

Cold Lime or Lime Soda Process

The cold lime or lime soda process consists of adding carefully measured dosages of lime or lime and soda ash plus a small amount of a coagulant. The chemicals react with the hardness constituents to form precipitates which are removed by settling and filtration. The process does not soften water completely for the precipitates produced are slightly soluble. However, as far as municipal water softening is concerned, this is a matter of small moment for usually the softening is carried out so as to leave a residual of about 5 gpg. The function of the lime is to remove carbon dioxide; to change bicarbonates to carbonates; and to change magnesium compounds to hydroxides. Soda ash is used only with waters containing non-carbonate hardness, changing this to carbonate. The coagulant is used to floc the precipitates into larger particles so that they will settle faster and more completely.

The softening costs depend on the composition of the water and the results required. Only one equivalent of lime is needed to change calcium bicarbonate to the carbonate, but two equivalents of lime are required to change magnesium bicarbonate to the hydroxide. One equivalent of soda ash is necessary to change calcium non-carbonate hardness to calcium carbonate, and soda ash treatment is much more expensive than lime treatment. In addition to the soda ash, magnesium non-carbonate hardness also requires one equivalent of lime. Taking the removal of calcium bicarbonate hardness as 1, the comparative costs of removing the various forms of hardness are as follows: Magnesium bicarbonate hardness, 2; calcium non-carbonate hardness, 5; and magnesium non-carbonate hardness, 6.

Some lime is also used up by the free carbon dioxide content of the water but this usually is slight because, if the free carbon dioxide is much above 10 ppm, it is reduced to or below that figure by aeration, and 10 ppm would require only 2 ounces of hydrated lime per 1000 gallons. The coagulant, usually aluminum sulfate or ferric sulfate, also liberates some carbon dioxide which uses some more lime. In calculating treatment dosages, it is simplest to modify the analysis of the raw water as if the coagulant had already been added before making the other calculations. For instance with 20 ppm of aluminum sulfate, free CO_2 will be increased 8 ppm and sulfates 9 ppm, while alkalinity will be decreased 9 ppm. For 20 ppm of ferrous sulfate, there will be an increase of 6 ppm of free CO_2 and 7 ppm of sulfates, with a reduction of 7 ppm of alkalinity. The figures for 10 ppm of ferric sulfate are +6, +6, and -6; and for 10 ppm sodium aluminate -6, +6 and none.

Effects of Coagulant Dosages

Without using excess chemicals, calcium hardness can be reduced to 35 ppm and magnesium hardness to 33 ppm or, in round figures, each can be reduced to 2 gpg, or a total of 4 gpg if both are present.

Very often, if the magnesium hardness is only a few grains per gallon, no attempt is made to reduce it, and the same may be said for small amounts of non-carbonate hardness. For instance, if the modified analysis showed 12 gpg of calcium bicarbonate hardness and 3 gpg of non-carbonate hardness, a water having a residual of 5 gpg could be reached without using any soda ash because the calcium bicarbonate hardness could be reduced to 2 gpg by lime alone.

Calcium non-carbonate hardness may be reduced to 2 gpg by the use of soda ash alone. With waters containing both calcium bicarbonate and calcium non-carbonate hardness, the total calcium hardness may be reduced to 2 gpg by the use of correctly proportioned dosages of lime and soda ash.

Magnesium bicarbonate hardness may be reduced by the use of lime alone to (1) to 4.7 gpg without producing a caustic effluent or (2) to 2 gpg with the production of an effluent having a causticity of 2 gpg. Magnesium non-carbonate hardness requires the use of both soda ash and lime and the total magnesium hardness may be reduced to either of the two residuals given above. It might also be added that if lime alone were added for the magnesium non-carbonate hardness, no reduction in total hardness would occur as this would simply change magnesium non-carbonate hardness to calcium non-carbonate hardness.

Table 1 gives the lime dosages required for the reduction of calcium bicarbonate hardness; Table 2 gives the lime dosages required for the reduction of both calcium bicarbonate hardness and magnesium bicarbonate hardness; and Table 3 gives the lime and soda ash dosages required for the reduction of total non-carbonate and bicarbonate hardness. In removing calcium bicarbonate in Table 1, the factors given for either magnesium bicarbonate or magnesium non-carbonate hardness are to be applied only to 10 percent of the magnesium hardness in the modified analysis (in whatever form it is present) because about 10 percent of the magnesium comes down with the calcium so enough lime must be added to take care of it.

These three tables apply only to the sludge blanket or solids contact type of units such as the Precipitator. Non-sludge blanket types of equipment require larger lime dosages.

● **COLD LIME softening plant at Carol City, Fla. Precipitator with degasifier in center; filters at right; the 14 gpg hardness water is softened to 5 gpg residual.**

Combination Lime-Zeolite Process

The so-called "combination lime-zeolite" process is two-stage in that the water is first treated with lime and the effluent is then passed through a zeolite water softener. There are some advantages to this process as the alkalinity and total solids content are reduced and, with certain waters, economies in operating costs may be effected. However, the capital costs are often almost twice as high as for either a cold lime plant or a zeolite plant by itself.

In the first stage of this process, the water is treated with lime to remove the bulk of the bicarbonate hardness. It is then filtered and passed through the zeolite water softeners which remove both the residual carbonate hardness and the non-carbonate hardness. This is the

Table 1—Lime Requirements for Calcium Bicarbonate Reduction

Analysis Constituent	Lime Required, lbs./1000 gals./ppm	
	Hydrated Lime	Chemical Lime
	93% $Ca(OH)_2$	90% CaO
Free Carbon Dioxide, ppm CO_2	0.0151	0.0118
Calcium Bicarbonate, ppm $CaCO_3$	0.0063	0.00519
Magnesium Bicarbonate, ppm $CaCO_3$	0.0133	0.0104
Magnesium Non-Carbonate, ppm $CaCO_3$	0.00663	0.00519

Table 2—Lime Requirements for Calcium and Magnesium Bicarbonate Reduction

Analysis Constituent	Lime Required, lbs./1000 gals./ppm	
	Hydrated Lime	Chemical Lime
	93% $Ca(OH)_2$	90% CaO
Free Carbon Dioxide, ppm CO_2	0.0151	0.0118
Total Alkalinity, ppm $CaCO_3$*	0.00663	0.00519
Magnesium Bicarbonate Removed, ppm $CaCO_3$	0.00663	0.00519
Causticity in Effluent, ppm $CaCO_3$	0.00663	0.00519

* If sodium alkalinity is present and magnesium bicarbonate is not to be reduced below 4.7 gpg, lime dosage may be reduced by an amount equivalent to the sodium alkalinity.

Table 3—Chemical Requirements for Bicarbonate and Non-Carbonate Reduction

Analysis Constituent	Chemicals Required, lbs./1000 gals./ppm		
	Hydrated Lime	Chemical Lime	Soda Ash
	93% $Ca(OH)_2$	90% CaO	98% Na_2CO_3
Free Carbon Dioxide, ppm CO_2	0.0151	0.0118	None
Total Alkalinity, ppm $CaCO_3$	0.00663	0.00519	None
Magnesium Non-Carbonate Removed, ppm, $CaCO_3$	0.00663	0.00519	0.00901
Causticity in Effluent, ppm $CaCO_3$	0.00663	0.00519	0.00901
Calcium Non-Carbonate, ppm $CaCO_3$	None	None	0.00901

way in which the process is handled for industrial uses where a zero hardness water is required. For municipal use, enough of the first stage effluent may be by-passed around the zeolite plant so that, when mixed with the zeolite effluent, a water of 4 to 5 gpg residual hardness will be produced.

Iron and Manganese Removal

Iron is objectionable in municipal water supplies as it stains everything with which it comes in contact, favors the growth of iron bacteria, and may cause objectionable tastes and odors.

In iron or manganese bearing, deep, ground waters, which have a bicarbonate alkalinity and are clear and colorless, these metals occur as the divalent bicarbonates—ferrous bicarbonate and/or manganous bicarbonate. Ferrous bicarbonate is a soluble, colorless salt so, when one of these iron bearing deep well waters is first drawn, they are clear and colorless. On standing in contact with air, however, a whitish haze is developed at first which then turns to yellowish-brown or reddish-brown, rusty stains and deposits. Manganese oxidizes much the same only much slower unless the pH is raised. Also the manganese deposits, unless associated with iron, are grayish to black in color.

If the municipal water softening plant is of the zeolite type there are several methods of iron removal. One is based on the fact that ferrous iron or manganous manganese may be removed, together with the calcium and magnesium, by the cation-exchanging properties of the zeolite. Therefore, all of the water passed through the zeolite water softener will not only have all of its hardness removed but also its iron and/or manganese content will simultaneously be reduced to unobjectionable amounts.

If the by-passed water contains not more than 1 ppm of iron or manganese, these may be removed by filtration through a manganese zeolite filter. This does not exert any softening action on the water but does oxidize the iron or manganese to insoluble forms and filters them out of the water. The deposits are removed by backwashing and at intervals, the oxidizing power of the bed is restored by regeneration with potassium permanganate. The main reason why this process is limited to waters containing not more than 1 ppm of these metals is because with higher amounts, other processes are cheaper. The capacity of the manganese zeolite is 0.09 lb. of iron or manganese, expressed as Fe or Mn, per cu. ft. and the amount of regenerant required is 0.18 lb. per cu. ft.

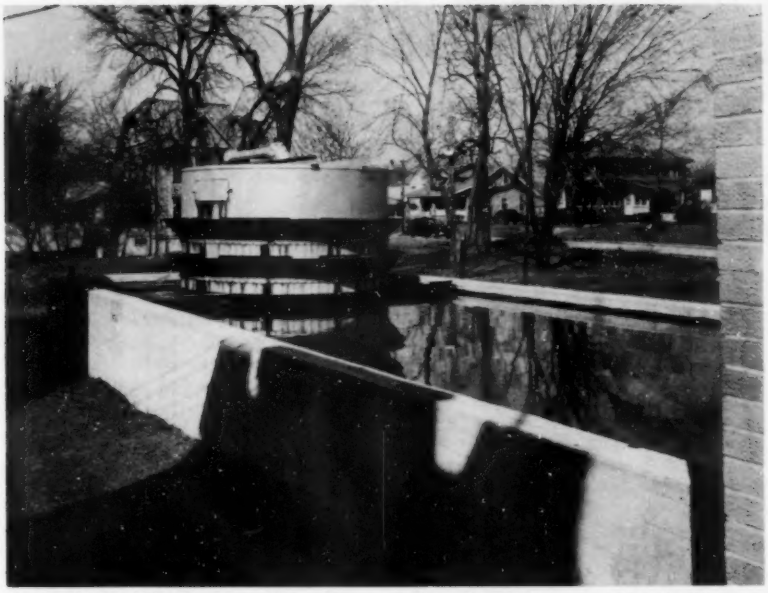
Another method of treating the by-pass water is by aeration, settling and filtration. This works well if iron alone is to be removed but, if manganese is also present, removal of the manganese is incomplete unless the pH is raised sufficiently high. In such cases, manganese zeolite filters may be used to complete the oxidation of the manganese, or in some cases, "ripened" filters are employed.

With iron-bearing waters which are to be softened for municipal use by the zeolite process, the most widely used method is to remove the iron before softening the water. In such cases, all of the water is aerated, settled, and filtered. Next, a portion of this iron-free water is passed through the zeolite softeners and enough of the iron-free hard water is mixed with it to give the desired hardness residual.

If the municipal water softening plant is of the cold lime or cold lime-soda type, the oxidation of iron and/or manganese from non-acid ground waters is simply carried out by aerating the water before it enters the softening equipment. Due to the high pH values obtaining in the process, oxidation of both iron and manganese to their insoluble forms is speedily accomplished. These are then removed, together with the precipitated hardness, by settling and filtration.

Iron oxidizes easily at pH values of 7.0 or more while manganese may require a pH of over 10.0. However, if "ripened filters" are employed—that is filters which have been run for a while so that there are manganese coatings on the filter medium—then a pH of 8.5 to 9.0 will usually be sufficient to remove the manganese.

While ferrous and manganous bicarbonates are soluble, their oxidation products are practically insoluble so, when aeration, settling and



● **IRON REMOVAL and zeolite softener at Normal, Ill., has capacity of 800 gpm. Iron content of raw water is 1.6 ppm; hardness is 16 gpg. All the water is treated.**

filtration are properly carried out, these are reduced well below the specified 0.3 ppm tolerance.

Chlorine is sometimes employed and this agent will oxidize ferrous bicarbonate at pH values appreciably below 7.0, in fact, even down to 5.0. Each 1 ppm of iron requires about 0.63 ppm of chlorine for oxidation to the ferric state. Chlorine, however, is of little value in oxidizing manganese for the pH required is almost as high as that required for oxidation by air. Acid ground waters are usually found in mining regions while acid surface waters are usually due to contamination by acid from mine drainage or trade wastes. Contrary to some beliefs, the soluble iron and manganese in such waters are present in the divalent state. Free sulfuric acid is practically always present and these waters may also contain some aluminum sulfate and suspended ferric hydroxide.

Some of these acid waters are so high in acid and sulfate content that it would not only be uneconomical to treat them but they would also be useless for drinking purposes after treatment. However, with waters which are not too badly contaminated with acid and sulfates, treatment consists of aeration, neutralization and filtration. The cold lime soda process, plus aeration, is best adapted to the treatment of acid waters.

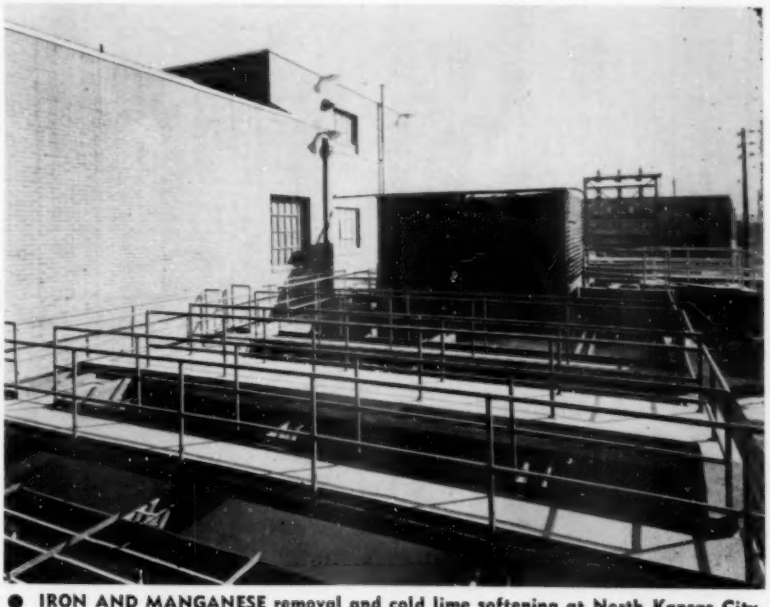
In high color waters, iron and/or manganese may be present in a "chelated" or organic form. These high color waters are usually surface waters which have originated in swampy areas and the color is due to various organic compounds leached out of decaying vegetable matter. However, there are also some well waters which have a high color and quite often these have a very appreciable iron or manganese content. These well waters are usually from aquifers lying under peat beds.

Iron or manganese, present in such form, cannot be removed by the usual aeration, settling and filtration processes nor do they come out when passed through a zeolite water softener. Even such a strong oxidizing agent as chlorine will often have little or no effect. These waters, however, usually respond very well to coagulation, settling and filtration which remove not only the color but also the iron and manganese. The coagulant which is most widely employed is aluminum sulfate, and the most effective pH values with most waters will range from about 5.5 to 6.8. Coagulation aids such as clay or activated silica are usually of value and in some southern waters, activated silica has been used by itself when the water was being softened by the cold lime process.

So, if a sample of an iron and/or manganese bearing water does not show a removal of these metals to below the specified tolerances when aerated at the proper pH value, allowed to stand, and then filtered through filter paper, coagulation and filtration tests should be initiated. These will quickly show whether or not organically bound (chelated) metals are present and what conditions are necessary for their removal.

Hydrogen sulfide may be removed by aeration but unfortunately not all of the sulfide in a sulfur water is present as hydrogen sulfide. Instead, as Pomeroy has shown, the relative amounts of sulfide present as hydrogen sulfide and as an alkali earth sulfide depend on the pH value of the water. If the water is acid, so that it has a pH of 5.0 or

(*Continued on page* 142)



● **IRON AND MANGANESE removal and cold lime softening at North Kansas City, Mo. With 5 ppm iron, 0.2 ppm manganese and 15 gpg hardness, capacity is 1,000 gpm.**

AERIAL PHOTOGRAPHY
IS A LOW COST AID
FOR TAX EQUALIZATION WORK

S. H. CHRISTOPHER,
Tax Engineer,
Whitfield County,
Dalton, Georgia

MANY LOCAL government units in Georgia are dependent primarily upon ad valorem tax revenue for operational funds and are often prevented from entering upon needed major improvements due to low tax digest figures.

This results from a system of voluntary returns made by property owners, many of whom tend to make such returns at low evaluation of their property. These returns are reviewed annually by an appointed Board of Tax Assessors who, to the best of their ability, endeavor to correct flagrant inequities during the short time they are in session, usually four or five weeks. Neither the Tax Receiver nor the Board of Assessors have any record, other than the returns, of the taxable property in the county.

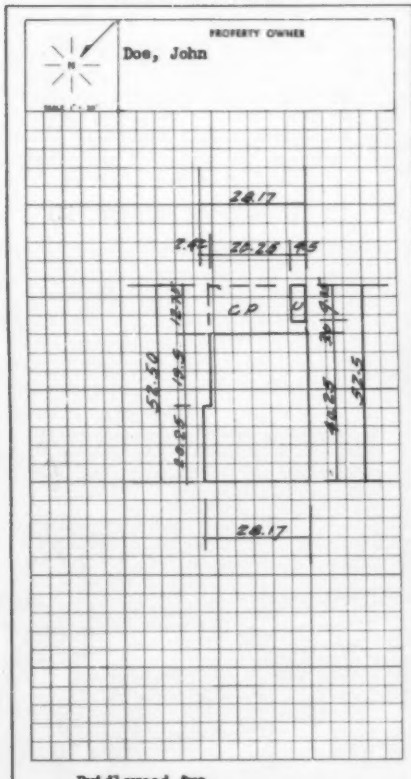
To obviate the difficulties inherent in the present system of ad valorem taxation, and to achieve a more equitable distribution of the tax burden, Whitfield County, Georgia, has undertaken a program of property inventory and evaluation. The first stage of the work is the accumulation of data on real property and this article describes the procedures used.

The basic need in such a program is the mapping of properties, a long and costly operation prior to the availability of aerial photography. Now the entire country has the advantage of low cost aerial photos on which to plot the various ownerships. These can be obtained from the U. S. Department of Agriculture, Washington, D. C.

Whitfield County comprises some 179,000 acres and the cost of aerial photos needed was less than $200,

RESIDENTIAL
PROPERTY RECORD CARD
WHITFIELD COUNTY, GEORGIA

PROPERTY OWNER: Doe, John



Bridlewood Ave.
PROPERTY ADDRESS

PLOTTED ☒ DRAWN BY R. R. DATE 7-10-57
RANDOM CLASSED BY S.H.C. DATE 7-20-57

CONSTRUCTION DATA

BUILDING 1 2 3 4	BUILDING 1 2 3 4	BUILDING 1 2 3 4
1. Dwelling	ROOF: Flat; Shed; Gable X; Hip; Gambrel; Roll; Shed; Stringles; Composition X; Metal; Wood; Asbestos; Tile; Slate; Notes	ROOMS: Res. Rooms 5; Rental Units; Efficiency Apts.; ___ Rm. Apts.; ___ Rm. Apts.; Notes
2.		
3.		
4.		
SUB-STRUCTURE: Slab; Piers X; Continuous Wall X; Conc. Bsmt. Floor; Semi-finished Bsmt.; Bsmt. Living Qrs.		PLUMBING: None; 1 Fixture Toilet; 2 Fixture Toilet; 2 Fixture Bath; 3 Fixture Bath X; 4 Fixture Bath; Tile Floor; 1/2 Tile Walls; Full Tile Walls; Notes
WALL FRAME: Wood X; Conc. Block; Tile; Brick; Stone; Rf. Concrete	FLOORS: Dirt; Single; Double X; Pine; Hardwood X; Concrete; Tile; Terrazzo; Notes	HEATING: None; Chimney X; Fireplace X; Steam; Hot Water; Forced Hot Air; Hot Air; Elec. X; Notes
SHEATHING: Yes X; None		
EXTERIOR WALLS: Unfinished; Wood; Roll; Sheet; Shingles; Composition; Metal; Asbestos; Stucco; Com. Brick; Face Brick X; Stone	INTERIOR WALLS: Unfinished; Wall Board; Ceiling; Plaster; Panel Board X; Plywood; Pine Panel; Hardwood Pan.; Notes	ELECTRICITY: Yes X; None; EQUIPMENT: Vent. Fan; Air Condition; Insulation X
	FURRING: Yes; None; Notes	

PHOTO NO.	PARCEL NO.
ATT-6P-36	125-12-1.14

SUBDIVISION: Country Club Estate — BLOCK:
LOTS OR DESCRIPTION: Lot 14

NOTES:
Brick veneer
Plastic tile bath
Elec. wall heaters
S. P. 500

TREND ☒ UP ☐ STATIC ☐ DOWN

NO.	CLASS	AREA	RATE	FLATS	REPL. COST	AGE	COND.	ADJ.	VALUE
1	1-1-3-B	1 221	7 60		9 300	1	1		9 300

ACRES	QUANTITY — TYPE DESCRIPTION	DIMENSIONS SQUARE FEET	UNIT PRICE	D.F.	C.F.	PRICE PER FRONT FOOT	VALUE
0.30	98 x 132	12,936	039				500

YEAR	VALUE 19 57	VALUE 19	VALUE 19	VALUE 19	VALUE 19	VALUE 19
LAND	500					
IMPRS.	9 300					
TOTAL	9 800					

● **TYPICAL APPRAISAL of residential property, showing record card used. Other forms cover farms and industrial holdings.**

which cost can vary depending on size and number of prints required. In this county photo enlargements of 14-in. by 14-in. size (4-ins. to the mile) are used, as this size can be used both in the field and for stereoscopic determination of physical features, and sufficient photos were secured to provide the latter. Additional photos of 36-in. by 36-in. size (1-in. equals 400 ft.) covering urban areas were purchased.

Equipment Needed

The engineering equipment needed are: engineer's scale, planimeter, stereoscope, slide rule and 50-ft. engineer's tape costing $60; and of course, office equipment for processing and filing completed work.

Before work was started in the field a numerical system of property identification was devised that would operate throughout the county, covering both rural and urban holdings. Original survey of the lands of the county was by land districts, which in turn were surveyed into lots of 160 acres, and numbered consecutively from one (1) and identical lot numbers occur in each district. There are six such districts in this county.

The Property Record Card shows the system in use with explanation of the meaning of parcel numbers. A complete file of all surveys and sub-divisions is maintained, which shows the properties by decimal system.

The county is also divided into Militia Districts, a legal division for voting purposes and which are not coterminous with land districts. Provision is made on property cards for showing this information, as the cards are filed by these districts.

Also the 8½-in. by 11-in. forms were made for residential, commercial and farms and timber lands, each type being printed on cards (for typing and filing) and on paper for field use. Also 5-in. by 8-in. ownership property cards are used, so that property may be identified either by name of owner or parcel number of the property.

As properties are continually changing in ownership, provision has been made to handle transfers as they occur on properties that have been mapped, so files are kept fully current as to the ownership at all times.

The problem of making appraisals for tax purposes is somewhat more difficult than setting up the record system, and competent personnel is needed for this purpose. The three types of properties in this county: farms and timberlands, rural and urban residential, and commercial, present different appraisal problems.

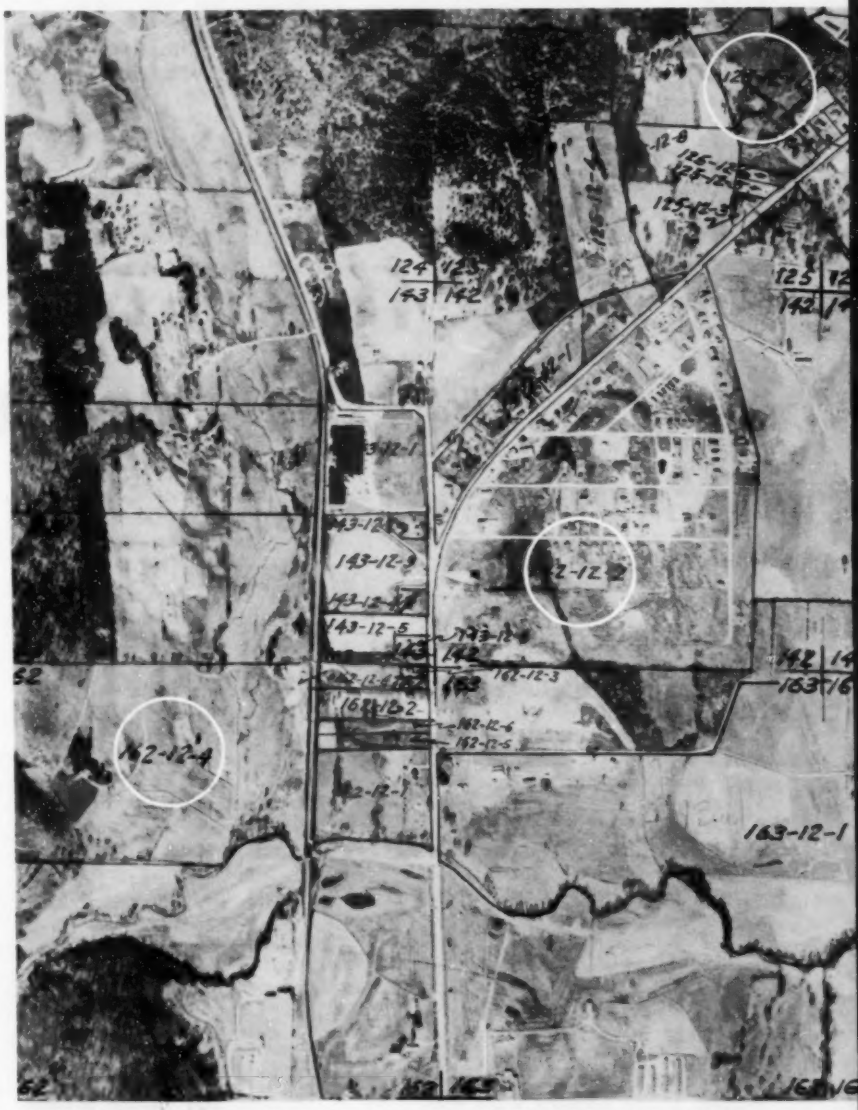
Urban Appraisals

The procedure used in appraising city and suburban residential properties, as well as residential lots on primary highways, is based on two factors, viz: land value and value of improvements.

The land values are determined from property sale trends in a particular section, with adjustments for topographic features requiring unusual expenditures for development and use. A land value map of city property is particularly useful, where a front foot value (based on 100-ft. depth) could be shown for each block facing. Adjustment tables for short or deep lots, corner factors, etc., would be used for obtaining value of a particular lot. The map should represent the composite thinking of a board of local real estate brokers operating as an advisory committee in the preparation of such a map.

In the appraisal of buildings and other improvements the appraiser should utilize all possible help from engineers, architects, contractors, and publications such as 'Building Cost Manual' (John Wiley & Sons, 1957), which presents cost data on approximately 150 separate building classifications. There are several companies that furnish evaluation data on a subscription basis that the appraisers will find invaluable.

As residences constitute the bulk of appraisals, we use a simplified



● **REPRODUCTION, about full size, of part of aerial photo. Number circled in upper right corner corresponds to parcel which includes lot detailed on opposite page.**

method of residential cost estimating developed and patented by Hunnicutt and Associates (Valuation Engineers of St. Petersburg, Florida). The system employs a specially designed slide rule incorporating the various factors involved in determining the basic square foot unit cost of a residence, viz: sub-structure, exterior walls, roof, floor, interior walls, plumbing, heating, electrical, and equipment. The total factor values vary from 40 percent to 175 percent through nine classes of residences (photographs and specifications of which are in the manual describing slide rule use). Use of this system is a real aid to tax appraisal work as fairly accurate appraisals can be made rapidly.

Farms and Timberlands

Many studies have shown that assessments on this class of real property have more inequities than in other types where values are more easily determined, such as urban residential—where property sales are more frequent and evaluations established.

Farm real estate is highly variable in value, dependent upon use, land capability, location of property with reference to markets, schools and churches; and also to other factors such as improved roads and adequate buildings for type of farming operation in effect. In the design of the Property Record Card for Farms and Timberlands these factors are considered in arriving at values. Provision is also made for appraising the land itself by classes, based on soil surveys of the Soil Conservation Service which delineates areas of land capability. There are eight land capability classes recognized by the soil scientists who make the surveys; however, only rarely are more than four encountered on any one farm.

A table of per acre values has been prepared for the various classes for crops and pasture use, which covers farming operations in this county. Timberland values are set up in a similar table by forest types, as follows: Pine type in three site classes, pine-hardwood type in two classes, hardwoods in two classes (bottomland or upland sites). Per acre values set up for timberland contain an increment of growth value, obviating the need for severance tax on this property class.

These per acre values are applied to acreage as determined by the soil surveys and stereoscopic interpretation of aerial photos as to forest type and class. Land evaluations are then adjusted according to factors previously mentioned.

Structural improvements are based on replacement cost, less depreciation (a combination of age and observation) and whether or not these are functionally necessary for the type of farming operation, and employ methods similar to those used for residential appraisals.

'En Masse' appraisals for tax purposes are not, as a rule, quite as accurate as appraisals made for other purposes; however, with the many appraisal techniques available today evaluations can be rapidly made that will be adequate for the purpose and make for a more equitable distribution of the tax burden in local governmental units.

How a City gets VALUABLE IDEAS from its EMPLOYEES

PHIL HIRSCH

AN EMPLOYEE suggestion system, inaugurated in July, 1956, is making a definite contribution to better municipal administration in Evanston, Ill., a few miles north of Chicago.

During its first year, the plan produced a total of 158 ideas, an average of three a week. Of these, 21 were accepted, 17 were still under consideration at the end of the year, and the others were found to be unworkable. The 21 suggestions came from employees in 11 of the 17 major departments which represent the bulk of Evanston's 600-employee municipal payroll. Cash awards totalling $300, paid out of a municipal contingency fund, were distributed. There were two $50 prizes; several amounted to $25; while the others ranged from $5 to $20.

Typical of the winning ideas was one calling for formation of a safety committee composed of representatives from each city department. The committee, formed a few months ago, meets regularly to develop methods of overcoming on-the-job safety hazards faced by municipal employees. Among its initial beneficiaries were members of the city's refuse collection crew.

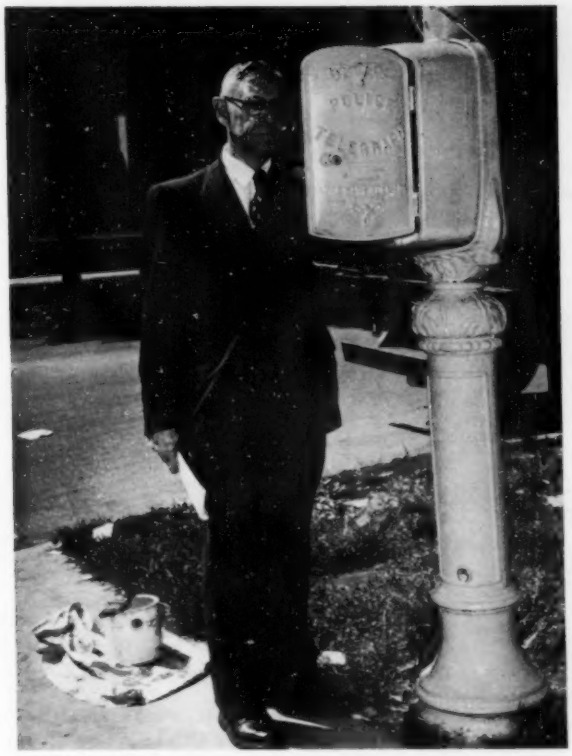
Some refuse pickup men had been suffering backstrain. Committee investigation revealed that the trouble was due partly to lack of knowledge regarding proper lifting procedure, and partly to the fact that not all refuse collection cans were equipped with handles. Some cans were replaced, and plans were made to organize a training class where experts from the National Safety Council and other groups could give members of the street and refuse department instruction in how to avoid accident and injury in this and other phases of their work.

Other prize-winning suggestions have ranged from a technique for reducing paperwork in the legal department, to a proposal for increasing the utilization of police call boxes.

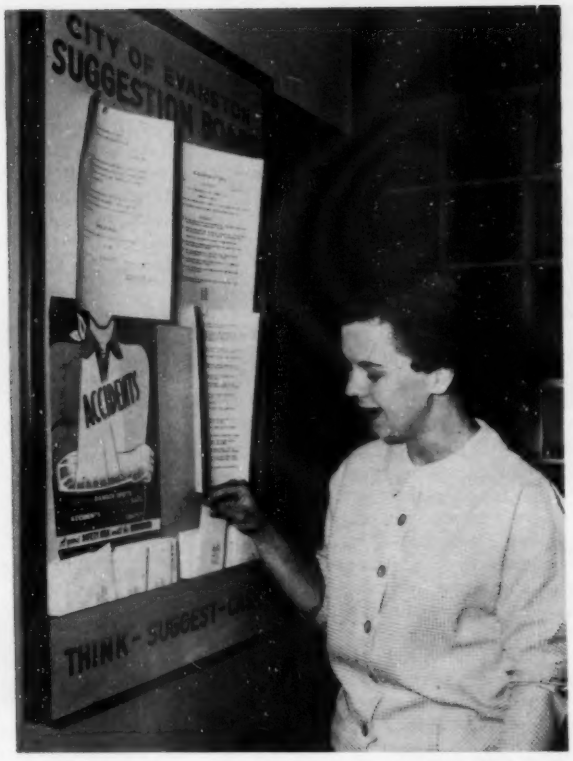
Evanston's suggestion system has certain intangible benefits which, in some ways, are at least as important as the ideas produced. Explains City Manager Bert Johnson:

"It is a well-known fact of human relations that whenever an employee has an active interest in doing his job better, he usually is a better worker. We feel the suggestion system, properly administered, is an effective way of cultivating this interest. For some employees, the cash award produces the proper incentive; for others, it is the honor and attention that flow from having their names posted on a bulletin board."

Without such a plan, adds Manager Johnson, workers often con-



● **ONE RESULT: Police call boxes are now painted white and left unlocked. Stacey B. Irish is shown in the picture.**



● **THERE are 13 suggestion boards in the Municipal Buildings. Award announcements are posted on the tack board above.**

ceive worthwhile ideas but feel their suggestions aren't ambitious enough, or will be ignored because of prejudice and apathy on the part of superiors. "A well-run suggestion system quickly overcomes both problems," he points out.

"Another benefit is that the municipal employee, because of his intimate, continuing contact with the practical aspects of a given job situation, frequently can offer an original approach to a problem," explains Evanston's city manager. "No group of policy-making officials can be all-knowing. Therefore, the larger the number of people sharing in the formulation of policy, even indirectly, the greater the chance of arriving at the best possible solution."

Suggestion Forms

Evanston's municipal employees submit their recommendations anonymously, on numbered forms, in envelopes addressed to City Manager Johnson. Anonymity is important, explains Personnel Director Stacey B. Irish, who is in charge of administering the suggestion system, because "it provides each contributor with 'built-in' assurance that his suggestion will be considered objectively on its merits."

The forms are stocked on 13 suggestion boards, manufactured in the municipal carpentry shop, and located strategically in all of Evanston's municipal buildings. Employees are asked first to describe briefly the existing operation of a given procedure or job, and then to tell their plan for changing it. The bottom of the form contains a listing of the possible benefits resulting from adoption of the suggestion (i.e., improved communications, reduced costs, lowered accident rate, improved service, etc.). The employee either checks off one of these items, or writes in the potential benefit separately on a line provided for the purpose.

Afterward, he tears off and retains a perforated stub at the bottom of the suggestion form which enables him to claim the award if his idea is accepted later on. He puts the form in the pre-addressed envelope (a supply of envelopes is kept in a slot at the bottom of each suggestion board), and brings or mails it to the city manager's office.

The weekly bulletin, besides listing the ideas received, is also intended to provoke further interest in the program with messages like the following:

"Some of those suggestions you've been holding back may be far better than you expect. Don't cheat yourself. We may think more of your idea than you do. Turn it in and see. There are golden opportunities all around you. Your daily work routine gives you the opportunity of seeing where many improvements can be made."

The bulletin announcing award winners also explains in detail why each rejected suggestion failed to make the grade. For example, one contributor who wanted to establish an employee lunchroom was told: "A basically good idea but seemingly impractical. Most employees bring their lunches, indicating that money is a factor."

Some of the Ideas

Below are some of the ideas that have been adopted to date:

One employee won $10 by suggesting that a signal system be set up, permitting Evanston's pumping station personnel to be warned automatically of an emergency at the filter plant (located in a separate building) on weekends and at night. During these periods, only one operator is on duty at the filter plant. The signal, which is to be installed shortly, will consist basically of a bell that goes off automatically in the pumphouse unless the filter plant operator pushes a button in his office signifying that all is well. Depressing the button will reset a timer-

actuated solenoid and keep the bell circuit open.

Another $10 award was given for a suggestion that signs be posted on the approaches to Evanston telling newcomers about the parking ordinance passed some time ago to facilitate street cleaning operations. On the odd-numbered dates of the month, Evanston requires motorists to park at night on the side of the street with odd-numbered addresses, and on the other side on even-numbered dates.

Five dollar prizes were awarded to two employees who showed why extra mechanics were needed in the municipal garage.

One of the top awards to date—$50—went to an employee in the city clerk's office who suggested a system for recording ordinances that has cut the amount of typing by 50 percent. The other $50 prize went to a worker in the water department who suggested increasing the penalty for late payment of water bills from $1 to $5. Besides the award, the employee will receive 10 percent of whatever revenue above $500 is produced by this suggestion during the first year it is in operation.

Another suggestion, worth $5, called for painting police call boxes white and leaving them unlocked to permit use by the public in an emergency.

Thanks to other suggestions turned in by municipal employees, Evanston has developed simpler, easier-to-process forms for: checking the personal references of job applicants, reporting traffic accidents, and obtaining permits from the zoning board. Also, each Evanston policeman and fireman now has an identification card, bearing his picture. The cards serve to identify members of the two departments quickly if they have to act officially during off-duty hours, and help to prevent imposters from deceiving the public. Other city personnel (meter readers, electrical inspectors, etc.) who must enter Evanston homes to perform their jobs will be equipped with the cards shortly.

Another employee suggestion enabled the city to reduce its dependence on temporary clerical help at certain times of the year. A regular worker is now moved from department to department, handling seasonal increases in the workload as they develop, and substituting for employees on vacation. This idea, besides cutting costs, has also improved the quality of the work done during peak-load periods.

"Although our suggestion system has been in effect only a little more than a year," reports Administrator Irish, "we are quite satisfied with it. We feel that the ideas obtained, as well as the increased job interest generated among employees, have more than repaid the time and money expended."

As each suggestion comes in, it is recorded in a register by Robert Edwards, the city manager's administrative assistant, who helps Personnel Director Irish in the operation of the suggestion program. The

● **NEW CARDS to identify police and fire personnel during off-duty hours was one suggestion accepted in the program.**

register has space for listing the suggestion form number, the date it was received, a brief description of the idea, the action taken by the award committee (discussed below), and other data. Purpose of the register is to make sure that no suggestions become misplaced and that all receive attention as promptly as possible.

After being logged, copies of the suggestion are sent to the supervisors and department heads whose operations would be most affected if the idea were adopted. These officials—at least two supervisors and a minimum of one department head in each case—are asked to fill out an 11-question form, returnable in five days to the suggestion administrator. The questionnaire asks, among other things, whether the employee's idea is practical, whether it has ever been considered before, and what the benefits—tangible as well as intangible—would be if it were adopted. Finally, each official is asked to recommend adoption or rejection.

Mr. Irish and the city manager's administrative assistant review these questionnaires, then send their recommendations, along with those of the department heads and supervisors, to the city manager, who makes the final decision.

When a suggestion has been received favorably by a majority of those assigned to review it, and has been approved by the city manager, the latter official then determines the size of the cash award. Where possible, the sum is related to the potential monetary benefits accruing from adoption of the idea. As a rule of thumb, the author of a worthwhile idea is awarded 10 percent of the total saving. Usually, however, it is impossible to determine what the dollar-and-cents benefits will be. The city manager then bases his valuation on such factors as the number of jobs which will be improved through adoption of the idea and the originality of the suggestion.

Although the maximum award to date has been $50, the plan affords the opportunity to go much higher if an idea is worthwhile enough. A figure of $250 is mentioned in the suggestion system information bulletins that were prepared when the program was launched in 1956, but even more might be paid for an especially valuable idea, explains Administrator Irish.

After ideas have been evaluated, a record of each suggestion is appended to the author's personnel folder, for possible use later on when the employee is being considered for promotion or pay raise.

Keeping employees informed of what is happening to their suggestions is crucially important to success of the program, believes Administrator Irish, for without adequate publicity, interest flags quickly. Each week, the suggestion administrator issues a "suggestion bulletin," which lists the ideas, by form number, that have been sent in during the previous seven days. Then, every five to six weeks, winning ideas are announced, again by form number, in a "general suggestion bulletin." Both bulletins are posted on the tack-boards located above each suggestion box.

• • •

Liquid Alum at Richmond Water Treatment Plant

At Richmond, Va., the city has converted its water treatment facilities to allow the use of liquid alum as a coagulant, the chemical becoming available from a new plant in Hopewell. Liquid alum is hauled in by tank truck and is stored in the elevated concrete wash water tank at Filter Plant No. 1, the tank having a capacity of 71,000 gallons. It is claimed that the conversion will result in a savings of $15,000 per year.

SEWAGE SLUDGE *Thickening* by Mechanical Vibration

GUENTER SPOHR,
President
Sonic Separation, Inc.,
Lake Hiawatha, N. J.
and
W. WESLEY ECKENFELDER, Jr.
Associate Professor of Civil Engineering,
Manhattan College, New York

THE HEYMANN sludge thickening process, which uses a vibrating screen and rotary filter press, was developed in Germany in 1954. It presents a new concept in mechanical sludge drying. This process, recently patented in the United States, has been installed in more than twenty sewage treatment plants in Germany and Switzerland. Extensive performance tests have been conducted since 1954 in Germany, in Switzerland in 1956-57, in Green Bay, Wis. and in West Paterson, N. J. Results have been uniformly successful.

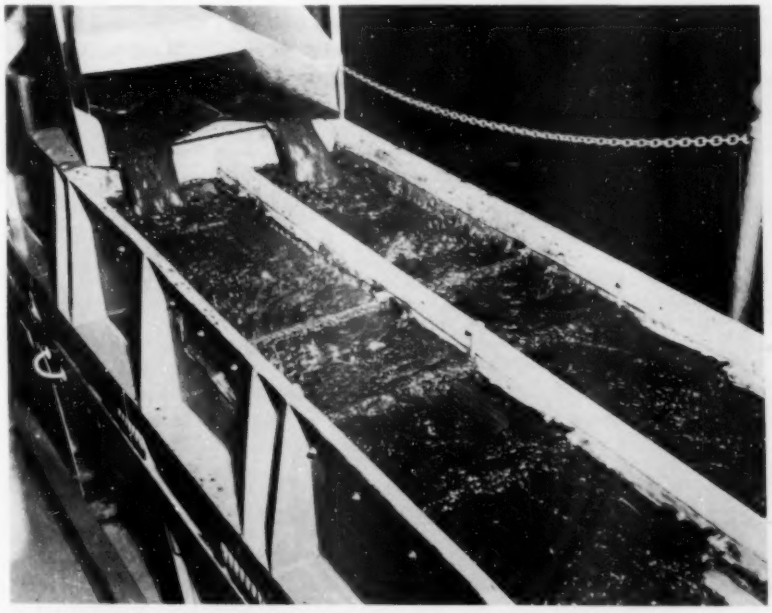
The sludge is introduced on the inlet end of the vibrating screen by gravity from a holding tank or by pump. The screen is equipped with combs spaced at intervals to regulate the detention of the sludge on the vibrator. The sludge is transported slowly across the vibrator while moisture is removed through filtrate lines from the bottom of the screen. The mechanism is vibrated at 1200 rpm involving a double amplitude of 7.8 to 8.4 mm. Following the vibrator the sludge is passed through a roller press in which additional moisture is removed. The roller press may also be vibrated to facilitate additional moisture removal.

Results of Tests

In September, 1957, a sludge thickener was installed at the municipal sewage treatment plant at West Paterson, N. J. The Imhoff tank digestion facilities had been overloaded for some time, and the sludge had a pH of 5.5 and a consistency of 8 to 10 percent solids. Further studies were conducted using normally digested sludge from the Little Falls, N. J., sewage treatment plant and raw primary sludge from the Lake Hiawatha, N. J., sewage treatment plant. The results of these studies are summarized in Table 1.

Results from municipal plants in Germany[1] in 1954 showed a reduction in moisture content of raw sludge from 93.4 percent to 74.5 percent. Air drying this sludge for 24 hrs. further reduced the 74.5 percent moisture content to 13.4 percent. Extensive studies on dewatering sludge for composting at Winterthur[2], Switzerland, in 1956-57 involved filtering both raw and digested sludge. For raw sludge, the concentration of solids in the vibrating screen filtrate was 0.5 percent and that in the sludge from the press was 38.6 percent. In the digested sludge run, the feed had a solids content of 10 percent, that in the screen filtrate was 8.8 percent, and the concentration in the sludge from the press was 28.6 percent solids. These Swiss studies were conducted at a feed rate of 790 gph for the digested sludge and 1,800 gph for the fresh sludge. The Swiss studies on digested sludge showed a reduction in moisture from 88.9 percent to 80.6 percent through the vibrating screen and a further reduction in moisture content to 75.8 percent through the filter press.

From the foregoing data it is seen that solids remain in the screen



● **SLUDGE from Imhoff tank is discharged from a feeder box onto the vibrating screens. Combs which are visible on the screens regulate and control sludge flow.**

TABLE 1—RESULTS OF SLUDGE DEWATERING TESTS

September to November, 1957

Type of Sludge	Source	Rate of Sludge Feed, gph	Total Solids, percent dry weight			Dewatered Sludge lbs./hr.
			Feed	Press	Screen Filtrate	
Imhoff	W. Paterson, N. J. (September)	600	8.1	29.0	5.0	——
Imhoff	W. Paterson, N. J. (October)	600	10.1	35.0	3.9	372
Imhoff	W. Paterson, N. J. (November)	1,000	10.0	28.6	7.3-9.2*	600
Raw	Lake Hiawatha, N. J.	900	3.76	25.7	3.04-2.16*	330
Digested	Little Falls, N. J.	950	5.32	28.5	———	185

*Filtrate from first and second drain lines of vibrating screen, respectively.

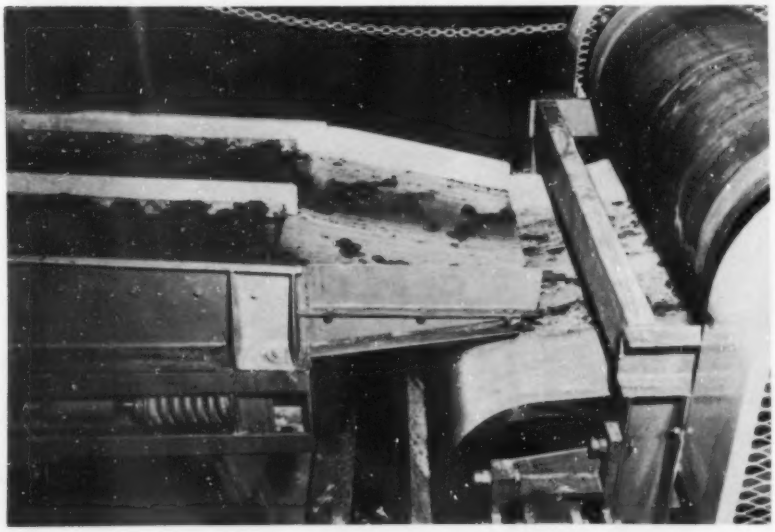
filtrate. Various methods are available for its further treatment. In many applications it is desirable to return the filtrate to a sludge thickener or primary tank. Further research is necessary, however, to determine the feasibility of doing this. Research in Germany and Switzerland has shown no detrimental effects from returning the filtrate to the sludge digester. As an alternate procedure, if necessary, a filtrate of high solids content can be applied to sand beds.

Filtrate from the Imhoff tank sludge reported in Table 1 was applied at a depth of 6 in. on a one-square foot experimental sand bed. After 2 days of air drying, the solids content of the sludge increased to 21.4 percent. Similar results have been reported from Tuttlingen, Germany, where an approximate area of 90 square yards of sand bed is required for 24,000 population. The sludge is applied to a depth of 4 inches and is removed after 24 hrs. and heaped. A unique design using steel tracks for access by rail cars facilitates rapid removal of the sludge from the bed.

The West Paterson, N.J., results indicated that the sludge from the press had substantially no odor in spite of a strong odor in the feed sludge. Results from Germany further indicate that the press sludge will rapidly dry in the air when heaped. It would appear that this sludge has superior drying qualities. This has been attributed to a change in the physical structure of the sludge mass due to the vibration process.

The unit uses no chemical conditioning or additives and operates without heating the sludge. The usual power requirement is 3 to 4 kw. The unit is operated intermittently, frequency depending on the volume and nature of sludge.

● **FILTRATE after air drying for 24 hours on sand bed at the plant at Tuttlingen, where this method is used.**



● **PARTIALLY dewatered sludge is shown coming off end of the vibrating screen and about to pass to the roll which provides the final step in dewatering process.**

Acknowledgment

The authors express their appreciation for the cooperation of the Mayor, Commissioner of Public Works, Superintendent and Assistant Superintendent of the sewage treatment plant of the Borough of West Paterson, N. J., where the American testing described in this article was conducted. The authors also acknowledge the assistance of several students of the Civil Engineering Department of Manhattan College in collecting and evaluating the samples.

References

1. Report: The Testing Station of the Land Wuerttemberg, Germany, for Agricultural Chemistry, Stuttgart—Hohenheim, June 18, 1954.
2. Report: Eidgenoessische Anstalt fuer Wasserversorgung und Gewaesserschutz an der ETH Zuerich No. 2308 Zuerich August 15, 1957. Institut fédéral pour l'aménagement l'épuration et la protection des eaux annexé à IEPF Zurich No. 2308.

Electronic Devices *for the* CIVIL ENGINEERING FIELD

TO FAMILIARIZE engineers in the public works field with the widespread applications of electronic equipment for the solution of problems in highway planning and design, in hydraulics and hydrology and in photogrammetry computations, the Editors of PUBLIC WORKS have compiled the following series of short articles. These describe several types of electronic computers, new electronic devices used for surveying and data plotting, and the services offered by firms specializing in the analysis of data through the use of electronic computers and related devices. Although these machines are already in use by state highway departments, the Bureau of Public Roads, consulting engineers and large contractors, it is felt that their application in the field of civil engineering has barely been touched. Every prediction indicates that in the next several years revolutionary changes will take place in highway construction and design through the use of electronic computers for the solution of engineering problems.

ADDRESSES OF FIRMS MENTIONED IN THIS ARTICLE

This group of articles on electronic computers, computer services and related electronic equipment was furnished by the fourteen companies listed below. For further details on these products and services or for information on the ways in which electronic devices may be used to help solve your own specific problems, please write direct to the firms listed.

Alwac Corporation
13040 South Cerise Avenue
Hawthorne, California

Autonetics Division
North American Aviation, Inc.
9150 E. Imperial Highway
Downey, California

Bendix Computer Division
Bendix Aviation Corp.
5630 Arbor Vitae Street
Los Angeles 45, California

The Datics Corporation
Texas Bank Building
Dallas, Texas

ElectroData Division
Burroughs Corporation
460 Sierra Madre Villa
Pasadena, California

Electronic Associates, Inc.
Long Branch, New Jersey

International Business Machines
590 Madison Avenue
New York 22, New York

Monroe Calculating Machine Co.
Orange, New Jersey

Photronix, Inc.
790 King Avenue
Columbus 12, Ohio

Ramo-Wooldridge Corp.
P. O. Box 45215
Airport Station
Los Angeles 45, Calif.

Remington Rand Division
Sperry Rand Corp.
315 Fourth Avenue
New York 10, New York

Royal McBee Corporation
Westchester Avenue
Port Chester, N. Y.

The Service Bureau Corp.
Subsidiary of IBM
425 Park Avenue
New York 22, New York

Tellurometer, Inc.
1346 Connecticut Ave., NW
Washington, D. C.

Alwac General Purpose Computers

Machines available from Alwac Corp. are general purpose computers, in two sizes. The smaller one, the III-E, is most useful in cut and fill calculations, photogrammetry calculations, bridge design and related problems. Its advantages for these purposes are its large capacity, its high speed, the flexibility of its output-input equipment and its low cost.

The III-E system is easy to code and is available for contract computing work on both coasts as well as at several centers in the United States and Canada. Operation manuals, coding manuals, installation and maintenance information, and all the standard publication support are available for Alwac systems.

Digital Computer By Autonetics

Autonetics, a Division of North American Aviation, Inc., has the portable Recomp, a general purpose, all-transistor, digital computer. It automatically performs very long sequences of computation, making decisions and referring to memory as it works. The unit can process and act on a continuous flow of information from its input-output facilities.

The operator has the option of using either fixed or floating decimal point arithmetic. A visual readout panel displays up to 15 decimal digits, with sign and floating decimal point, which can be controlled by the internal program or the input-output facilities. Any memory or arithmetic information can be displayed on the readout. New programs and stored information can

● **ROAD engineers can take 200-lb. "Recomp II" right to their problems.**

be automatically verified at any time with the original tape. Any discrepancies will stop the process, flash an error light and allow the stored information to be corrected. A typewriter or tape-punch error or malfunction will stop the computer and flash the error light. Numbers, commands, or location can be entered, read or changed at any time. All operating controls are conveniently located on the control panel.

The Recomp can solve problems in bridge design; traverse closure; area computation; cut and fill calculations; borrow pit computations; traffic analysis and simulation; roadway design; grade profile calculations; and drainage.

Bendix G-15 General Purpose Computer

The Bendix G-15 general purpose computer solves highway earthmoving problems of as many as 230 cross sections in 45 minutes at a total cost of $38.80. In preparing such data for input into the computer, 1 to 1½ minutes are consumed in typing the factors for each cross section, or about 5 hours for the 230 cross sections. The computer time in the actual solution is about 12 seconds.

The results for each station include the following: Depth of cut or fill at left slope stake; horizontal distance of left slope stake from center line; cut and fill volume between preceding station and present station; cumulative total of cut and fill volumes to include shrinkage factor; depth of cut or fill at right slope stake; and horizontal distance of right slope stake from the center line.

Bridge geometrics, camber problems, analysis of rectangular reinforced concrete columns, traverse closures and composite beam design are also solved.

Rental is available in any user's office, and on a time basis in Washington, D. C., and Kennett Square, Pa. Many usual problems have already been programmed so only clerical costs to prepare information, plus actual machine time to run the problems is charged. If a program has to be modified, a programming charge may be added. Under the lease agreement, maintenance is provided; and a maintenance contract is also available on purchased equipment.

Training courses for qualified personnel in operation and maintenance are included in both the purchase and lease price lists. The customer's engineers are usually best qualified

● **TYPICAL installation of the new Bendix G-15 General Purpose Computer.**

for the analytical portion of the programming. For the actually coding of a problem so that it is acceptable to the computer, less critical personnel can be used.

Problems Solved on Contract by Datics

The Datics Corp. has rented or purchased equipment and provides computer service on a contract basis to any client. An IBM magnetic drum computer and Benson-Lehner data reduction equipment are available.

Solutions for water network problems have been developed using the standard Hardy Cross method of solution. Datics places in the computer data which will produce the correct flows and head losses in a network having a maximum of 50 loops and a maximum number of 500 lines. All computer operating personnel is provided by Datics. The price charged for this work is 42 cents per loop per iteration. The customer—consulting engineer or city—can lower costs by having a close approximation to the final flow in the network. The charge includes the services of all machine operating personnel; the customer is not required to learn digital machine programming.

For example, a 10-loop network which requires 6 iterations to converge to the required accuracy will cost $25.20. A 50-loop network requiring the same number of iterations will cost $126.00 for each solution. The Hardy Cross method is applied in the following manner: On a data sheet, supplied by Datics, the engineer provides information on the K factor for each line; the assumed Q flow in each line on the basis of 100 percent total flow into the network; the assumed direction of flow in each line; and the loops in the network with which each line is associated. A maximum of 50 loops can be solved and a maximum of 10 lines can be a part of each loop. Water can be introduced or withdrawn at any juncture of lines in the network in any amount. During the course of the iterations, the quantities and (if necessary) the directions of flow in the lines will be automatically altered. A balance on each loop is made by the computer to meet any specified tolerance. The output will give (for each loop) the correct flow quantity; the flow direction; the head loss and the direction of head loss for each line in that loop. The engineer may then make engineering modifications to his proposed network (vary input

● **PART of the computing facilities available at the Datics Corporation.**

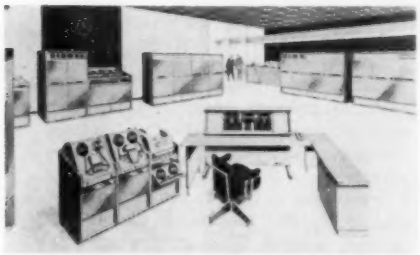
points, output points, line sizes, etc.) to solve his total problem.

Besides Hardy Cross water network problems, structural problems by the Hardy Cross method; cut and fill earthwork calculations; electrical network design problems; survey closure problems; water flood and routing problems; and pipe stress calculations can be solved. Engineers on Datics staff are prepared to adapt any engineering problem to the computer. The computer is ordinarily rented at $80 per hour. Programming and man power necessary to adapt any engineering problem to any computer in the continental United States are available from Datics.

Computer from ElectroData

The Datatron furnished by ElectroData Division of Burroughs Corp. is a general purpose computer that can solve problems in bridge design, traverse closure, earthwork computations, pipeline design, data reduction and nuclear reactor design. It can also be used in billing, payroll accounting and tax accounting. The high-speed magnetic drum has a storage capacity of 40,800 digits and a speed of 500 additions and subtractions, 85 divisions, or 120 multiplications per second.

Using a general traverse closure problem as one example of what the Datatron will do, the program will permit a solution regardless of the conditions which occur. These conditions may be any of the following: 1) All distances and bearings are known; 2) the distance of one course is unknown; 3) the bearing of one



● **EQUIPMENT set-up for the Datatron 220 electronic data processing system.**

course is unknown; 4) the distance of one course and the bearing of that same course are unknown; 5) the distance of two courses are unknown; 6) the distance of one course and the bearing of another course are unknown; or 7) the bearings of two courses are unknown.

Dataplotter from Electronic Associates

Electronic Associates, Inc., has the Dataplotter, an electronic device which converts digital point data to accurate continuous line presentations of the highway profile and cross sections. This unit, Model 1963, automatically reduces the data from the punched cards or punched tape to a legible, usable form of reproducible drawings while requiring little or no additional equipment or special programming techniques.

The line plotting accessory may be conveniently de-activated by a control panel switch to facilitate point plotting when required. The same pen may be utilized for point plotting; or, if several curves are desired on one plotting sheet, the Model 17-25C symbol printer may be conveniently used.

IBM Electronic Computer

Since June, 1956, when the California Department of Public Works

● **LINE plotting by the Dataplotting system of Electronics Associates, Inc.**

installed the first IBM type 650, magnetic drum data processing machine, 11 650's have been installed in highway departments and 11 more are on order. Several states and one county have made use of the 704 computer for their large and difficult problems. Applications being made in city, county and state departments of Public Works for such computers include:

Highway planning. Continuous traffic counts, coverage counts, highway needs tabulation, freeway traffic assignment, metropolitan desire line chart, O and D studies, traffic accident analysis, traffic placement and statistical studies;

Highway design. Design earthwork and final pay earthwork calculations, road design, borrow pit and right-of-way calculations, traverses and closures, ground control of aerial photos, soil stability analysis, determination of density of granular material, seeding area and rock quantity calculations.

Bridge design. X-beam composite design, loadings to influence lines for maximum values, multiple column pier bents, culvert design, multiple span skew bridge alinement, concrete columns, cantilever girders, arches and rigid frames, deflections, abutments, cost comparison of bridge types, location of centerline bents, determination of minimum span, length along centerline bearings, extension and summation of reinforcing steel quantities, influence lines in continuous beams, composite simple spans and moment distribution.

Other. Computations of seasonal factors, special research studies,

● **IBM 650 data processing system is widely used for difficult computations.**

unit bid price analysis, sub-estimates of bid breakdowns, maintenance costs summary and pipeline network analysis.

Equipment may be rented from IBM and installed in a customers own premises; it may be bought outright; or it may be rented with option to buy. The rental price includes complete and continuous maintenance service throughout the period of the rental contract, but on purchased equipment the customer has an option. On either rental or purchase, free training by IBM is provided for sufficient members of the organization to operate the equipment ordered. This consists of initial training before installation, refresher courses from time to time, and schools and seminars held at convenient locations throughout the country.

Monroe Calculator

The Monroe Monro-Matic 88N duplex is a calculator featuring automatic decimals, multi-factor multiplication, simultaneous accumula-

● **MONROE also makes this all-electronic Monrobot IX, priced near $10,000, for general accounting functions.**

tion, selective division and automatic carriage positioning. The automatic decimals on the Monroe single keyboard simplifies entry of figures by allowing them to be placed around a single decimal position. In multi-factor multiplication any number of factors may be multiplied together

without setting the intermediate answer on the keyboard.

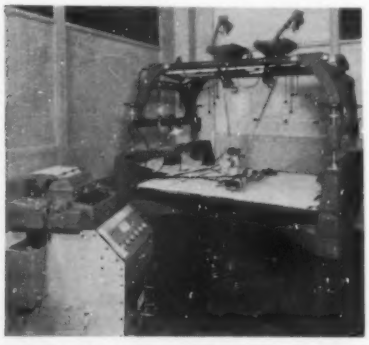
After a multiplication or division, products or quotients automatically accumulate; at the same time results of each individual problem appear in another dial. The computer allows the operator to divide automatically into the "Memory Dials" for averages or unit cost results. A side division problem can be done without affecting the memory dial accumulation.

Following a multiplication, the carriage automatically positions itself, ready for addition or subtraction without shifting the carriage to line up the decimals. Decimals are always automatic. In division, the answer decimal is predetermined by the automatic carriage positioning.

Highway Design By Photronix

Photronix, Inc., is a service for increasing engineering productivity by the integration of aerial photography, photogrammetry and electronic computation. In aerial photography a Wild RC-5a camera is used which is distortion free, resulting in sharp and well defined photographic plates. Planimetric and topographic maps of any size and scale covering the entire area of influence are provided. Cross sections are taken by photogrammetric point readings and automatically recorded in a form directly usable by the electronic computer. These products of aerial photogrammetry furnish the engineer with maximum usable data on which to make grade and alinement decisions.

Utilizing the data which has been automatically recorded from photogrammetric interpolation, along with the basic design criteria systematically punched into cards, the electronic computer and related equipment develops the data required for the following: Location study; profile; superelevation; proposed roadway design; earthwork; drainage; bridge design; and plan quantities.

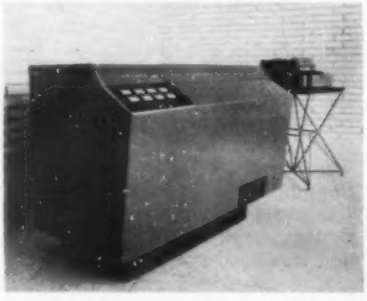


● **KELSH plotter with Photronix Computer is for use on aerial survey work.**

Maps, cross sections, drawings and printed computer tabulations are reproduced photographically on linen sheets for direct inclusion in construction plans. Final measurements are accomplished by the same method of aerial photography, photogrammetry and electronic computation.

Ramo-Wooldridge Digital Computer and Process Controller

The R-W Computer-Controller is a transistorized digital computer which will provide fully automatic control for industrial process plants. It consists of a basic unit, including a general-purpose stored-program digital computer, and an input-output unit. A typewriter on which instrument data and other variables can be logged and a punched paper input device for inserting digital information are provided. The computer weighs approximately 400 pounds, and is 55 by 28 by 36 inches.



● **COMPACT Ramo-Wooldridge digital computer and process controller.**

Design objectives were to produce a digital computer that, when used as the central unit of a process control system, could automatically read process instruments, perform the computations necessary to relate these readings to process objectives, determine the control actions that would result in best plant operation, and activate process mechanisms or adjust set points on supervised control loops. The computer can also be used for general purpose scientific computation and to perform the monitoring function of a data logger.

Though specifically designed to control automatically such industrial processes as oil refining, pipeline operation, and chemical manufacture, the RW-300 also has public works applications. Typical examples are computations for and control of automobile traffic; of sewage treatment and water conditioning; and of power generating and distributing plants.

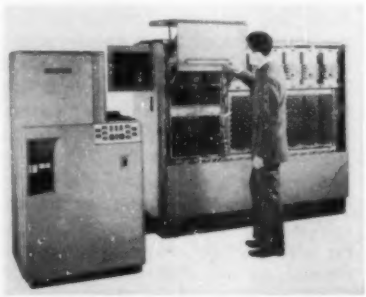
Remington Rand Computers

The first step in the application of any computing system to a particular engineering problem must be taken by the engineer. It is much simpler to train an engineer to program a computer than it is to train a computer programmer in the complex engineering techniques required. The engineer-programmer must analyze the problem, plan the steps to a logical and efficient solution, and instruct the computer how to proceed through the medium of program boards for the given job.

As a second step, the engineer must provide the computer with source material in a language acceptable to the computer, generally by punched cards which the computer understands.

Computers, such as the Remington Rand Univac 120, enable the engineer to convert cross section plus and minus elevations to actual ground elevations at a rate of approximately 40 stations per minute, allowing up to twenty elevations per station, or 800 individual elevations in one minute. This computer will also provide a preliminary estimate of areas and volumes as well as final estimates.

Basic engineering procedures are utilized. A center line control for horizontal measurements common to both grade and ground elevations must be used. Each half of the roadway is computed independently of the other. Areas of cut and fill are computed by the trapezoidal rule and volumes by the average end-area method. Univac 120 programs are designed to use all cross section notes recorded in the field books that are within the roadway prism. Slope stake catch points are computed and punched into cards.



● **UNIVAC computers are useful on many earthwork and bridge design jobs.**

To begin the computing operation, original survey field notes showing the station, center line elevation (ground) and cross section distance and elevation readings are recorded by the survey party and sent to the computing section. The ground line is plotted on the profile and the profile grade is laid. The P.I. points with their respective elevations are noted together with the tangent grade. The vertical curve length and maximum correction factors are determined and recorded. The proper recording of this information provides all the factors required for calculation of station grade elevations. Where district or field offices are located at distant points survey book information can be transmitted by punched paper tape to the central computer.

Whenever a change in original design grade is required, adjustments can be made and the stations affected by the grade change can be recomputed at the rate of approximately 90 stations per minute. Final areas and volumes may also be computed. In cases where soil calculations are required, percentages and factors may be programmed to provide the necessary information. The computer can provide station balance points in report form.

A State Highway Department which has utilized the Univac 120 Computer for more than two years recently completed a time study covering the manual and computer operations required to calculate one cross section. The complete operation on a manual basis required 30.99 minutes compared with 2.972 minutes using the computer.

Bridge and structural design also lend themselves to computer operation due to the iterative computations involved in the development of design information. One consulting engineer utilized the Univac 120 computer to develop 17 bridge computations in the same length of time that one manual computation was developed formerly.

Traverse closure, water flow and areas served by storm sewers, piping flexibility analysis, simultaneous equations, right-of-way calculations, traffic analysis, and various hydraulic problems are some of the engineering operations where the computer is used to provide speedy solutions.

Many computer programs are of the type that can be used by all engineers with the same basic problem. These programs are being tested by the Bureau of Public Roads for the development of a computer program library which will be available to engineers. Most computer manufacturers now have program libraries available for new users of their equipment for this application. The Remington Rand Univac 120 engineering program library contains over 45 programs for various engineering problems.

Electronic Computer From Royal McBee

The LGP-30, made by Royal McBee Corp., is a general-purpose electronic digital computer that fills the need for a small-sized, reliable and low-priced scientific computing device. An electric typewriter gives alpha-numeric entries or output by punched tape or keyboard. The computer is internally binary, which permits simplicity of design; yet the operator may enter information in customary decimal form and receive the results in decimal form.

The LG-30 control panel allows the operator to concentrate on his problem rather than on the operation of the machine. For instance, the operational status of the computer is visibly indicated by the stop, compute and stand-by-to-operate lights. Also, individual switches light up to show when a specific one may be depressed. Interlocks between the various switches on the panel minimize the possibility of contradictory instructions.

● **INPUT-output electric typer is standard on Royal electronic computer.**

Service Bureau Electronic Calculations

The Service Bureau Corporation furnishes a calculating service based on a staff of mathematicians and engineers, supported by electronic digital computers of various types. All work is done on a contract basis, and three different approaches are possible: (a) SBC's staff prepare a program to suit the special needs of the engineer; (b) SBC modifies one of its basic programs to make it suitable for the engineer's needs; or (c) the engineer prepares his own program and uses SBC equipment for the processing.

Since all work is done on a contract basis, the charge covers only the work done—often less than a tenth of the cost of manual methods. For example, use of an SBC program for Hardy Cross analysis of hydraulic networks reduced the cost of network calculations in one job from $10,000 to $500. The additional benefits, increased accuracy and reduction of elapsed time by 6 to 12 months, are more difficult to assess. An SBC cut-and-fill program cut earthwork computation cost by a factor of ten, but more importantly gave the opportunity for money-saving revisions in design.

● **IBM-650 is the machine used in the Service Bureau Corporation offices.**

The Service Bureau Corporation maintains offices in principal cities throughout the country. Each of these offices is equipped with modern data processing equipment. SBC owns and maintains all necessary equipment. Problems solved by the computers include:

Soils Engineering. Pressure distribution in layered media; design charts for relief-well systems of partially penetrating wells; and freezing and thawing of soils.

Highway Engineering. Cut and fill; traverse closure; traverse adjustment (compass and transit rules, least squares); transformation of coordinates (Mercator, Lambert, Local Plane, etc.); photogrammetric data reduction; and estimating.

Structural and Mechanical. Truss analysis, stress and deflections; analysis of reinforced concrete, bending and direct stress; heat flow in concrete; shell analysis, stress distribution; analysis of rigid frames, moment distribution; effects of foundation settlements; temperature stresses; arch analysis and design; cam design; critical speeds; pipe-stress analysis; moments of inertia; and air conditioning.

(*Continued on page* 162)

WE REDUCE COST AND IMPROVE REFUSE COLLECTION WITH MODERN LARGER BODIES

CARL C. FAGERLIND,
Street Commissioner,
Waterloo, Iowa

BY STARTING a program of conversion from 9- to 16-yard refuse collection bodies, we have been able to handle recent extensive city growth without increasing our crews or the number of trucks. At the same time we have substituted carries for curb pickups in outlying areas and have cut the truck operation cost by three cents per mile.

We are well along on converting 25 acres of wild river-bottom land to valuable industrial or park site property in such a clean, inoffensive landfill operation that the public clamors for similar reclamation work in many other residential areas. Salvage operations at the landfill also brought us more income last year than it cost to operate the disposal ground.

Our incentive system for the men on collection routes has been so attractive that more applicants than we can handle keep wanting to switch from the street department to garbage crews. This eagerness directly reverses the usual situation.

The expansion picture behind all this in Waterloo has been one of steady but not booming growth. Today's estimated population of 73,500 reflects a gain of nearly 13,500 since the 1950 census of 65,198. The city covers 31.9 square miles.

As street commissioner, I have charge of both the street and sanitation departments. Directly heading the garbage collection and landfill operation is Foreman William Mussett, who does an outstanding job of route assignment and supervision. Keeping in touch with the office and garage by two-way radio, he exercises general field control and also handles calls about missed pickups.

Against that background, our present operation consists of twice-a-week summertime pickups of residential table waste—garbage, bottles and cans all wrapped together. This system prevails for about seven months of the year. During the other five months, from late October through early March, collections are made once each week.

We operate nine routes in the summer and cut down to six in the winter. Each truck has a three-man crew—driver and two helpers. Thus the department has 27 employees for peak-season coverage and 18 during the cold-weather months plus one foreman.

Through most of the postwar period our equipment consisted of 9-yard Heil bodies on Dodge and Ford trucks. We reached the point finally where there had to be either an increase in crews and trucks or a change to larger units on the same number of routes to handle a growing volume of refuse. So last May we replaced four of the 9-yard bodies with 16-yard Heil Colectomatics on International chassis. We still have six of the nine-yard trucks (one spare) and hope to get about four more of the new larger bodies in 1958.

In order to extend service to all the city's new additions with our old smaller trucks, it had been necessary for residents in certain outlying districts to place their refuse cans on the curb for pickup by our crews. People complained about it, but budget limitations left no other choice. The 16-yard units immediately let us give the same service to these newer districts as to older parts of town. Now there are no more curbside placements. Collections currently include about 75 percent alley pickups and 25 percent carries from behind or beside the house.

Economies of operation by the larger Colectomatics also have shown up in a number of comparisons. We found, for example, that five loads on a nine-yard truck comprise about 20,640 pounds of refuse—a little over 10 tons. It takes a 16-yard unit only three loads to haul that same volume. Likewise, a typical nine-yard truck's daily summer haul in two trips to the dump is about 9,000 pounds. A 16-yarder handles 9,700 pounds in one trip.

One of our 16-yard trucks served 2,095 dwelling units on one collection round at the mid-July peak this year. On a comparable route in a similar residential neighborhood, one nine-yard unit was serving only 1,573 units in the same length of time.

As to mileage, the 16-yard Heil went 35 miles on its route while the 9-yard unit, with more trips to the landfill necessary because of smaller load capacity, traveled 48 miles. The entire fleet of 9-yard trucks averaged an operating cost of 20 cents a mile through all of 1956. The trend with 16-yard bodies this year indicates that they will produce a three-cent per mile reduction from that figure.

A typical summertime route covers 250 to 350 blocks one time around. There is an average haul of about five miles from the routes to the landfill area. From the landfill to the garage where vehicles are maintained and stored, the distance is one-half mile. Trucks start from the garage each morning for an average 4½-mile trip to the beginning point of routes.

Our plan to replace more nine-yard bodies with 16-yard units next year will make it possible to keep up with continued city expansion. It also may even permit elimination of one crew as a further cost-cutting step.

Garbage Collection Budget

Although the present system does not include collection of rubbish other than table waste, eventually we hope to add other types of trash to the pickup operation. If this comes about within a period of years, it will require a further expansion of fleet and crews. Under the present setup, our garbage collection budget for 1957 is $111,642. In 1956 it totaled $104,582.36.

The terminal point for all pickup work—our landfill dump along the Cedar river in southeast Waterloo—has been a source of civic pride ever since it was opened five years ago. Former Mayor Glen Stech referred to the sanitary landfill as one of the city's best operations and the biggest civic improvement in recent years. What used to be a rat- and mosquito-infested area, overgrown with trees and brush, is becoming 25 acres of good flat ground strategically located for possible future use either by industry or as a new city park.

One island has been removed, the channel straightened and a new dike built to contain the river at high water stage. In some places, dry land exists now where 12 to 15 feet of water once stood. Current fill work includes reinforcement of the dike on its inland side for further protection. Two to three feet of dirt cover goes on top of all compacted refuse. The whole Riverview section of town thus faces general improvement in an area where floods formerly forced evacuation of 600 or 700 homes.

The landfill ground now being used was bought by the city many years ago with park use in mind. But city development went in other directions so that this never came about. Waterloo's first landfill was established in 1946 in an outlying area, ending an era of open dump disposal. There was still much public skepticism when we tried landfill on another area close to the downtown district between a park and a cemetery. Many people didn't believe it would work, but quickly changed their minds. Two lighted ball fields now sprawl across the old landfill.

Our present landfill is open to the public at all times for dumping of materials and objects not picked up by the city. One full-time employee operates a D-7 Caterpillar bulldozer all through the year. A part-time man runs a tractor and scraper for six months, pulling up dirt and stockpiling it for use as cover.

In my opinion, about 75 percent of the credit for our landfill's success should go to the bulldozer man, Harold Heidemann. I show him what area we will tackle next, and he takes it from there. In any town, I believe, the success of a sanitary landfill operation depends mostly on the caliber of the operator who handles it.

In a typical week the past summer, the dump received 449 loads of garbage, 1473 of trash, 72 of dirt, 222 of broken rough material, 34 of paper and rags, 42 of scrap metal and 25 of junk furniture, appliances and the like. To receive and compact those 2,317 loads cost $443.71 for an average cost per load of slightly over 19 cents.

Last year's entire landfill cost was $4,197, not counting the $50 a week we paid a man to head salvage operations.

Working as a city employee, he puts in 12 to 14 hours a day and helps direct the dumping of various loads that come in. He hauls away salvage material and keeps half the proceeds from paper and iron. The city gets the other half, plus all receipts from sale of rags and miscellaneous items sold from time to time. We have found this arrangement far more satisfactory than the system of several years ago when a man was allowed to do the salvaging for whatever he could make from it.

Above and beyond the $50 a week paid to our present salvage man, the city netted $4,456.38 last year from sales of salvage material. That continued a steady increase since the system began. Our share was $3,660.79 in 1955 and $1,686.17 in 1954. Last year's $4,456.38 to the city also exceeded our entire landfill operation cost of $4,197—thus actually showing a slight overall profit for the taxpayers.

Meanwhile, the collection crewmen were just about as happy with the incentive system they worked under as we were with the salvage situation. In a six-day workweek, the routes are arranged to include four big ones and two with less territory so that Wednesdays and Saturdays can be shorter days.

Waterloo was one of the first cities to try an incentive arrangement, starting it in 1937. After the men cover their designated daily route, their work is done no matter what time they may finish up. Summertime usually finds them starting around 4 am and they often finish by 10. In the winter they go out later, but even we have trouble sometimes trying to keep them from starting too early. This early-finish arrangement lets some of the men hold part-time jobs elsewhere. The rest have more than half a normal day to do whatever they like each afternoon. On the routes they often run to make time, with drivers handling corner pickups to help speed the routine. Wages are on a monthly basis, not hourly. Truck drivers get $337 and helpers $330. This amounts to about $1.98 an hour for drivers and $1.92 for helpers. The workweek averages usually less than 38 hours.

This has been so appealing to the men that we have a waiting list of street department employees wanting to shift to garbage collection work. Much of our summer help is from college boys who like garbage crew duty as it enables them to spend the afternoon on golf, swimming or other sports.

Collection crews work all holidays not falling on a Sunday. The men usually manage to make these shorter than usual but still keep up with their routes. We let them accumulate holiday time and take it later as extra days on their regular vacations.

By and large, public cooperation with our whole program has been good, even without any special educational effort on our part. We operate as though the people are our customers and the big job for us is to give them good, business-like service.

● 16-YARD refuse collection units by Heil replace older and smaller trucks.

● SLATE is loaded into trucks by a 3/4-yd. shovel and applied to the roadway in two separately compacted lifts of 4 in. each.

● CRUSHED slate on road is examined by Maintenance Engineer Rutledge, left, and County Engineer Waldenberger.

COUNTY ROAD STABILIZATION *with* CALCIUM CHLORIDE

● WINTER and long dry spell did not seriously affect the road surface quality.

LOUIS J. WALDENBERGER,

County Highways Engineer,

Bel Air, Maryland

THERE ARE 585 miles of road in Harford County, Maryland, and 315 miles of this are hard surfaced with the remainder gravel. Each year fifteen miles of road are constructed while four to five miles of old macadam roads are rehabilitated. The roads are built 28 ft. wide, ditch to ditch, with 18 feet of hard wearing surface and 5-ft. shoulders. The hard surface is of 3-inch penetration macadam. All rehabilitation work is done with a moto-paver and widening work is accomplished by using slate as a base. Slate is also used as a base for new road construction.

In 1955, an attempt was made to get a better compacted base. In order to do this, the crusher was overhauled and readjusted to make it possible to take the slate as it comes from the secondary crusher and place it on the road. The slate is laid in lifts of 4 inches and a 10-ton, 2-wheel roller is used for compaction and also to crush in place the aggregate in order to make additional fines. After a second lift which gives an 8-inch base has been thoroughly compacted and sufficient fines brought to the surface to lock all large aggregate, calcium chloride is applied at the rate of 1½ pounds per square yard. Before calcium chloride is applied the base material is sprayed thoroughly with water under pressure.

For all excavation and grading Caterpillar and Allis-Chalmers equipment is used. For the hauling of excavation material and the base material, County owned trucks are used. On some roads where we have rock, a Northwest ¾-yard shovel is brought into service. The rollers used are Hercules and Galion and in side ditching and sloping a Gradall is utilized.

The calcium chloride treatment was explored by using it on roads that had been compacted under traffic for several years. It is to be noted that slate does not cube, for when it comes from the crusher it has a flat elongated shape. The County Highway Department was getting a great number of complaints because of cut tires. It was found in 1955 through 1956 that applying calcium chloride to the well compacted surface decreased the number of complaints on the roads that were used for experimental purposes. This led to the step of crushing in place with a roller in order to bring the fines to the surface.

As of this date, we know that the calcium chloride treatment will hold for a period of one year. We then may find it necessary to add from 0.3 to 0.5 pound per square yard. This depends entirely upon the season, and whether it is wet or dry. Also using crushed slate with this treatment has decreased the cost of the base material approximately 20 percent. This saving is over crusher run from commercial quarries.

● **TICKETING** overtime parkers is one part of the parking control officer's job. She is also ready to . . .

● **MAKE CHANGE** for parkers, give directions of all sorts and be helpful in general. In addition, she . . .

● **KEEPS METERS** wound and makes minor repairs. She's even trained to help the police find stolen automobiles.

WOMEN PARKING OFFICERS HELP PUBLIC RELATIONS

LACKING personnel in the Police Department for control of parking meters, loading zones and no-parking areas in the business districts, H. M. DeNoble, director of Planning and Traffic of Springfield, Mo., suggested that the responsibility be turned over to his department. He proposed that the program be carried out by women parking control officers as he had had previous satisfactory experience with such officers in Lubbock, Tex.

With the approval of the Council specifications were prepared and applications were received. Of the 40 applicants, 6 were selected and, after undergoing physical and aptitude tests, were employed. Arrangements were made at once for tailored uniforms; and a 2-week training program was initiated. This carefully planned program included instruction on duties and functions, such as the following:

Street locations; important buildings and offices; bus routes and bus schedules; and location and telephone numbers of the Police and Fire Department headquarters, hospitals, ambulance services and doctors. The appointees were instructed by the Judge of the Municipal Court on their functions in court when it should be necessary for them to appear. They also spent considerable time in the courtroom to see actual traffic cases carried through and also in the traffic court clerk's office reviewing the processing of the tickets.

The Municipal Prosecuting Attorney instructed them on cases before the Municipal Court and also in regard to the proper writing of the parking tickets. The officers spent a day in the Police Department learning of the functions of the Police Department from the Police Chief, Chief of Detectives, and the Chief of Patrol. They were shown how the Police Department could assist the women patrol officers and how the women patrol officers could help the police in locating stolen automobiles, etc. Another day was spent in reviewing and studying the location of fire stations and visiting the fire stations to see the actual functions of the fire department. Two days were spent in reviewing bus routes and time schedules and in riding all buses, keeping in mind the location of important buildings, schools, etc.

Several days were spent in touring the metered areas in a vehicle; all types of incidents and circumstances were pointed out to them in the way of traffic control and conditions that they would encounter. Two days were spent in the parking meter maintenance shop where they learned the operation of parking meters, how to repair them, to unjam them, to make minor repairs, and to keep them in working order. Two days were spent walking the actual meter routes pointing out the different circumstances and conditions that they would encounter while being on duty.

Additional briefings were carried out by the Director and members of the Planning and Traffic Department instructing the officers in their duties and functions—and what was expected of them while performing their duties, such as giving change to citizens when requested, helping people across the street—either by helping them personally or carrying packages—actual baby sitting in some instances while someone runs into a store; answering questions asked by citizens and tourists passing through the city; and how to handle different circumstances that they may encounter while in the line of duty.

Training Period Completed

At the completion of the training period, the officers were uniformed and a complete day was spent on final inspection, testing, etc., at which time pictures were taken by all news medias and by the Police Department for use on their special Police Commissions. The women were issued the following items in order to carry out the duties of their department: Uniforms; leather handbags, special badges, keys to the tops of the parking meters, in order to fix and repair the mech-

anisms; winding cranks for the meters; screw drivers; plier; and $5 which they are required at all times to keep in small currency in order to be able to furnish change to citizens and other people desiring change.

Each officer at the beginning of her training session was given a small loose leaf booklet for taking notes during training and for carrying instructions and orders; lists of street names; bus routes; phone numbers, etc.

Immediately following the final inspection and information day the officers went to work patrolling the parking meter routes. The job of patrolling the parking meters is a 6-day a week job and, under the present setup, there are 6 officers to patrol the city's 1700 parking meters. The schedule set up for the officers was 5 officers to be on each day with one officer off each day, with a rotating system whereby an officer off on Monday of one week would be off on Tuesday the next week and so on so that every fifth week each officer would have a long weekend consisting of Saturday, Sunday and Monday. This system was set up rather than the regular day off for each officer in order to give them a better opportunity to have more time at home.

Duty Schedule

Although the parking meters are enforceable from 8:00 A.M. to 6:00 P.M. each day, except Friday when they are enforceable up to 9:00 P.M., the officers work only 8 hours a day and at the present time are starting at 8:30 A.M. and work through to 4:30 P.M. Under the present setup the officers eat lunch in their regular 8-hour period, taking the minimum of time to do so in order to get back on the parking meter route and enforce the traffic ordinance. The schedule is set up for a revolving system whereby the officers will start at 8:30 and work until 4:30 P.M. one week, the next week from 9:00 A.M. to 5:00 P.M. and the next week 8:00 A.M. to 4:00 P.M. This revolving system is used in order properly to enforce metering at different hours. On the hours the parking control officers are not in the metered area, the police department handles the work —the last hour each day and for the evening hours on Friday night. It was determined that the women officers should not be used for night work and so this work is done by the Police Department.

Each morning the five officers check into the Planning and Traffic Department at which time they receive their tickets and other information needed for duty. All of the officers check back in at the close of the working day to the Planning and Traffic Department, at which time they turn over the copies of the tickets they have issued to the vehicles while on their meter routes. These tickets are then processed by the Planning and Traffic Department and separated and then are turned over to the Municipal Court. The officers at the close of the day also turn into the Planning and Traffic Office the actual numbers of the meters that they have had to repair, wind, etc. They also turn over to the Department a list of all license numbers of all vehicles not having the city's

● **PATROL officers ready for duty.**

vehicle license, which is required in the City of Springfield. This list is then turned over to the Police Department for action in regard to city stickers. All important instructions that should be retained by the officers are typed upon sheets to fit their booklet and they are issued those at their check-in and check-out periods. Minor instructions are given to them orally. A check of the officers' work is kept constantly by reviewing their work in the field by occasional inspections and checks along their meter routes and another check is kept by tabulation of the tickets that they have issued, the time of the day they were issued, the number of tickets that were voided, the number of times they got around their routes, etc.

Their routes are so laid off in five areas that the officers will get around their routes at least once every 60 to 75 minutes, depending upon the number of tickets that they have to issue for vehicles in violation of the traffic ordinance. The officers not only patrol the meters on their routes but also the four parking lots owned and operated by the City of Springfield. They also enforce the traffic ordinance in regard to the 12-minute, 30-minute, 1-hour, 2-hour, and 12-hour parking meters and the loading zone restrictions in regard to passenger and freight loading, bus and taxi zones. They issue tickets for parking violations in no-parking zones, fire hydrant zones, theatre zones, and other parking ordinance infringements.

Limits of Responsibility

However, the officers do not issue any tickets for moving violations, such as speeding, running stop signs, jaywalking, etc. This is done by the Police Department. The officers, it should be noted, are employees of the Planning and Traffic Department and thereby are not involved in the enforcement of the moving violations against the traffic ordinance of the city. They at no time enter the coin box of the parking meters and not not carry keys to open these boxes. The officers are not to windowshop, engage in unnecessary conversation, put money into the meters for anyone, pass out handbills, and miscellaneous other items that are outlined in the instructions which are very complete, but too long to include here. Possibly a copy can be obtained from H. M. DeNoble, Director of Traffic & Planning, Springfield, Mo.

As was expected, enforcement of the metered areas jumped up considerably. The number of tickets issued increased from 100 to 200 a week on parking violations to 1,000 to 1,500 a week. As a result, the all-day parkers taking up valuable parking space in the city were forced from the parking meters to private parking lots, public parking lots, and the non-metered areas. The results were also a faster turnover in vehicles resulting in a better service to people desiring to do business in the business districts. Also people using the parking meters were inserting their money in the parking meters and people who had no business in the loading zones were not using them. Enforcement also stopped the circulation of traffic seeking parking spaces continually circling blocks and looking for them, because now meter spaces are available for the short-time parker especially at the short-time parking meters. Also there has been an increase in parking meter revenue, which was expected.

● **THIS SWEEPER owned by Baltimore County's Department of Public Works has been in operation for about six months.**

NEW SWEEPER

Expands Baltimore County Services

RESIDENTIAL developments have brought a new suburban character to many parts of Baltimore County, Maryland, as they have to most metropolitan areas throughout the country. This trend is accompanied by demands for municipal-type services in unincorporated areas.

One important service for new developments is regularly scheduled street cleaning, since the residents want their street kept as neat and clean as those of their neighbors living within the city limits. The following data from Robert J. Hajzyk, Chief of the Bureau of Operations of Baltimore County's Department of Public Works tells how his county is developing street cleaning service for residential areas.

Equipment Goals

"For several years we have been expanding the services of our Sanitation Department. We have now added to our services that of leaf collecting in the Fall. At present we have four leaf collecting units, with an ultimate goal of 16. We now have four street sweepers, and hope eventually to have about 12. At this time we are able to clean approximately 1,800 curb miles in Baltimore County on the average of once every two months. Of course, some areas such as commercial and highly residential sections receive more attention than others, but the average is only once every two months on the whole. It is our intention to expand our Sanitation Department with additional sweepers and personnel so that we may be able to sweep every curb mile in Baltimore County at least once a week."

Newest of the street sweeping units is a Mobil Sweeper, made by the Conveyor Co. of Los Angeles and pictured on this page. This machine has been in use for approximately six months. Mr. Hajzyk reports that the operator is very happy with the sweeper because of its versatility and speed in traveling to and from the job, and also in traveling to the landfill area for disposal of the sweepings. Other features which the operator finds advantageous are the sight distance in front of the truck and the location of the gutter broom, which is directly below and at the side of the driver, making it convenient to regulate the machine when sweeping along the gutter lines. The location of the rear broom pleases the officials too, because it is at the rear of the truck where it does not cause dust and dirt to pass up through the motor.

Maintenance costs on the new equipment cannot yet be given since the machine has been in operation for only a few months, but from all indications maintenance costs on this unit will be low.

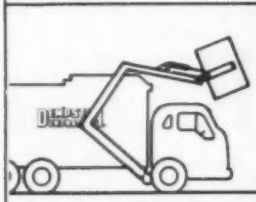
How to Meet Demands

Once-a-week sweeping on all the county streets wil be a big undertaking, observes Mr. Hajzyk, since, as he says, "Everyone is conscious of keeping down the tax rate, but as demands come in our only recourse is to try to expand such services, and the only way I know is to increase the funds available for this work."

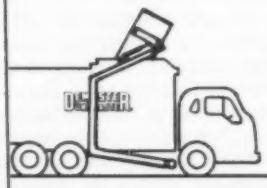
Self-Loading Dempster-Dumpmaster Handles Big-Capacity Containers

Loads Manually . .

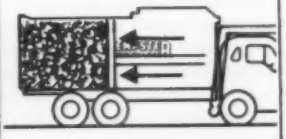
Or Handles Containers Automatically



Hoists Containers Overhead



Empties and Puts Them Down



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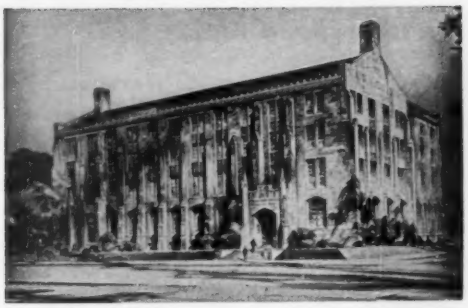


AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Board of Directors Holds Annual Meeting in Chicago

The Board of Directors of the American Public Works Association held its annual mid-winter meeting at the Headquarters Office in Chicago on Friday, January 31, 1958. The largest budget in the history of the Association totaling $120,000 was approved for the current fiscal year. Preliminary plans were also made for the 1958 Public Works Congress and Equipment Show to be held in Kansas City, Mo., September 28-October 1. Contracts for exhibit space at this forthcoming meeting are now being accepted by the headquarters staff in Chicago. Plans for the annual membership campaign were also formulated and approved at this meeting.

Progress reports on the excellent work of several APWA Committees were presented to the Board. Of particular importance was the report that the 1958 edition of "Refuse Collection Practice" is now in the hands of the printer, and should be ready for distribution within the next few months.

One of the most significant actions taken by the Board was the approval of a plan to present an APWA Short Course in Municipal Public Works Administration in cooperation with the Institute for Training in Municipal Administration. As soon as plans for the course are fully developed, it will be offered to persons engaged in the management of municipal public works activities, through the Local Chapters of the APWA. The Board of Directors also authorized the establishment of a new Committee on Equipment, and another on Buildings and Grounds. The membership of these Committees and new appointments to existing Committees will be announced in the near future. Other actions taken by the Board will likewise be reported at a later date.

Offner Becomes Chairman of APWA Research Foundation

The President of the American Public Works Association recently announced the appointment of William Foster, Editor, The American City, as a Trustee of the APWA Research Foundation for a three-year term. Edward J. Cleary, Executive Director and Chief Engineer, Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio, and F. H. Zurmuhlen, Commissioner, Department of Public Works, New York City, were reappointed to another term on the Board of Trustees.

Mr. Offner

Milton Offner, Secretary, Board of Public Works, Los Angeles, California, was elected Chairman of the Foundation at its last annual meeting. Offner, who succeeds Col. W. A. Hardenbergh, Editor, PUBLIC WORKS, assumed his duties as Chairman in January, 1958. Samuel Baxter, Commissioner, Water Department, Philadelphia, Pa., is the new Vice-Chairman of the Board.

The APWA Research Foundation was organized in 1955 to serve state and local units of government by continually evaluating the scientific status of public works activity, by identifying its major problems, by determining the most promising approaches to their solution, and by providing a practical means by which cities and public-spirited individuals and organizations may voluntarily contribute to the support of a comprehensive research program in this field. Nearly two hundred cities and other units of government are already supporting the work of the Foundation through a special type of membership in the American Public Works Association.

LOCAL CHAPTER ACTIVITIES

Several Chapters of the APWA held meetings during recent months and many others are planning meetings in the near future. The Northern California Chapter held a meeting in Oakland on January 17, 1958, and heard an informative talk on public works planning by Harmon E. Davis, Director of the Institute of Transportation and Traffic Engineering of the University of California.

The Michigan Chapter held a regular monthly meeting at Hucks' Redford Inn near Detroit on Thursday, January 16. Herman D. Ellis, Director of Public Relations for the Mackinac Bridge Authority, discussed the history of the construction of this new bridge which was dedicated last year and illustrated his talk with some excellent colored slides. The Philadelphia Metropolitan Chapter held its last monthly

OFFICERS: Sol Ellenson, Newport News, Va., *President;* Wm. D. Hurst, Winnipeg, Manitoba, Canada, *Vice President.* **REGIONAL DIRECTORS:** (term ending 1958) Jean L. Vincenz, San Diego, Calif.; Leo Flotron, Dayton, Ohio; Roy W. McLeese, Salt Lake City, Utah; (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas. *Immediate Past President,* Robert Anderson, Winnetka, Ill. Donald F. Herrick, *Executive Director*

meeting at the Engineers' Club. The program featured a talk on the reconstruction of the Spring Garden Street Bridge by John Buckley, President of Buckley Company, Inc., of Philadelphia.

Some of the meetings scheduled for the near future are listed below. Further details may be obtained from the Chapter Secretaries.

Iowa Chapter—March 12-13, 1958, Iowa State College, Ames.
(William D. McElwee, City Engineer, City Hall, Muscatine, Iowa—Sec'y.-Treas.)

San Diego Imperial Chapter—March 20, 1958, San Diego.
(Robert Hoke, Sales Engr., American Bitumuls & Asphalt Co., 2351 Colton Ave., San Diego, Calif.—Sec'y.-Treas.)

Up-State New York Chapter—May 11-13, 1958, Rochester, N. Y.
(Kenneth Miller, Assoc. Engineer, Dept. of Public Works, 242 Main St., Rochester, N. Y.—Sec'y.-Treas.)

Chicago Metropolitan Chapter—May 22, 1958, Midwest Country Club, Hinsdale, Ill.
(Charles V. Sramek, Ward Supt., City of Chicago, 5040 W. Lawrence Ave., Chicago 30, Ill. —Sec'y.-Treas.)

Western Public Works Conference—June 15-18, 1958, Cortez Hotel, San Diego, Calif.
(V. L. Larson, Chairman, Host Committee; 3940 Seventh Ave., Room 103; San Diego 3, Calif.)

Smallwood Represents APWA at Highway Research Board Meeting

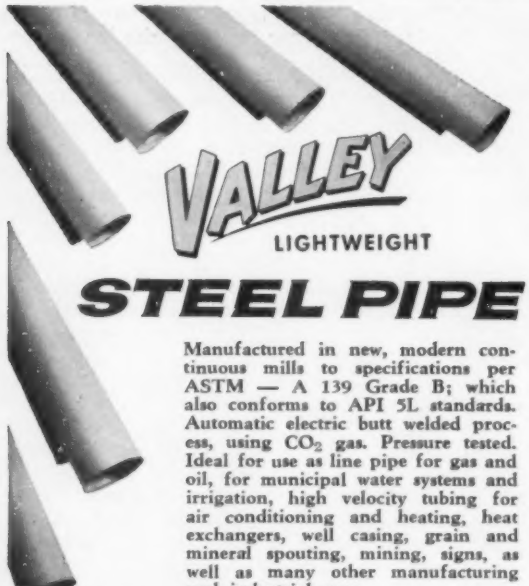
David M. Smallwood, Street Commissioner for the City of Philadelphia, attended the 37th Annual Meeting of the Highway Research Board in Washington, D. C. from January 7 to 10, and also attended its Annual Business Meeting as the official representative of the American Public Works Association.

Mr. Smallwood

Commissioner Smallwood reports that over two hundred and twenty-five papers were presented. The opening session of the general meeting included greetings by Detlev W. Bronck, President of the National Academy of Sciences; the conferring of awards; the Annual Report of the Chairman of the Board, Rex M. Whitton; and addresses by M. M. Boring, Chairman of the National Academy of Sciences Advisory Board on Education, and by W. A. Bugge, Director of the Washington State Highway Commission.

Mr. Boring spoke on the technical manpower problem, including in his remarks the recommendation that we should all look at our present utilization of engineers and detach them from the work that could be done by a "technician" having two years of college training. He further indicated that most of us are discouraging creativeness in the young graduate and that we should push this young graduate to the foreground, solicit his ideas, give him the opportunity to meet with the experienced engineer, and encourage his participation in professional meetings.

A constant theme throughout the entire sessions indicated the desirability for the highway engineers to consult with other specialists in the determination of highway plans. Wilford Owen, Transportation Specialist for the Brookings Institute of Washington, D. C. cautioned that our construction of expressways should not move our slum areas to the suburbs and thus make our origins and destinations poor places



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Smooth concrete inner surfaces which cannot tuberculate make the pipe's initial high carrying capacity permanent. Result: low pumping costs and full capacity in the future when even greater demands may be made on the line.

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in which to live, that highways are a means to an end, and that we are kidding ourselves if we forget this simple fact.

Interim reports were presented for several research projects on the use of continuous reinforcement in paving. These reports did not indicate a concurrence in conclusions, but the report from New Jersey should warn us against jumping to continuous reinforcement as a standard. William Van Breemen of the New Jersey State Highway Department remarked that after ten years their continuous reinforcement experiment showed no superiority over their standard reinforced pavement, despite higher cost.

A number of excellent papers analyzed generation and characteristics of trip travel, contributing very substantially to our knowledge of the subject and certainly helping toward the forecast of future travel. Alan Voorhees of the Automotive Safety Foundation uttered a startling warning against the common usage of 10 percent of the average daily traffic as the peak hour design volume. Studies and analyses he made of many origin and destination surveys showed ranges of peak hour volumes as high as 60 percent of the average daily traffic.

The Highway Laws Committee is one of the most active and productive within the Highway Research Board, and is carrying on an excellent program in analyzing present laws, indicating their weakness and need of implementation, and in looking toward entirely new concepts in highway legislation. A thought which came out of the meeting of this committee which could be investigated in any jurisdiction, was the possibility of buying restrictive rights to property in excess of the condemned right of way, so as to control land usage prior to the official adoption of a comprehensive plan.

The possibility of operating automobiles by electronic control in the future was indicated as being feasible from a trial installation being conducted by RCA Laboratories at Princeton, New Jersey. The Committee on Highway Laws noted the aspects of such development and the complex legal problems that would emanate.

BPR Issues New Memorandum on Reimbursement for Utility Work

A new statement of policy regarding payment procedures for the reimbursement of costs incurred in adjusting utility facilities in connection with Federal-aid highway projects was recently approved by the Bureau of Public Roads of the U. S. Department of Commerce.

BPR Policy and Procedure Memorandum 30-4, issued December 31, 1957 by direction of B. D. Tallamy, Federal Highway Administrator, supersedes General Administrative Memorandum 300, which previously dealt with this subject.

The Federal-aid Highway Act of 1956 specifies that "whenever a State shall pay for the cost of relocation of utility facilities necessitated by the construction of a project on the Federal-aid primary or secondary systems, or on the Interstate System, including extensions thereof within urban areas, Federal funds may be used to reimburse the State for such cost in the same proportion as Federal funds are expended on the project". This new memorandum pertains to the disbursement of Federal funds in accordance with this provision of the 1956 legislation, which also stipulates that the Federal Government shall pay 90 percent of the cost of highways on the Interstate System, and 50 percent of the cost of the other Federal-aid highways or extensions thereof in urban areas.

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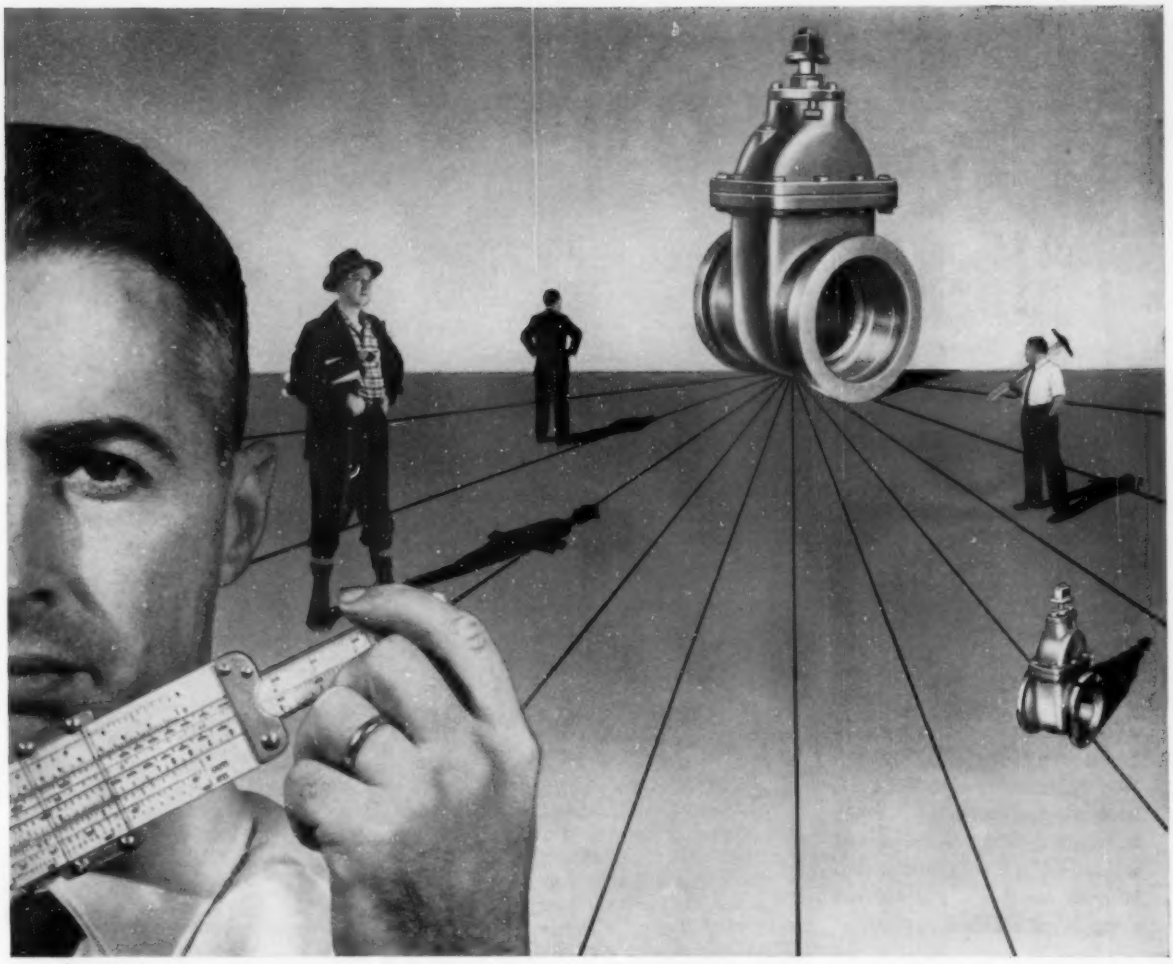

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Sound design and quality workmanship to guarantee ease of operation, watertight closure, years of trouble-free performance

The perfect gate valve, according to engineers and water superintendents, must combine simplicity and soundness of design, tightness of closure, ease of operation and quality of workmanship.

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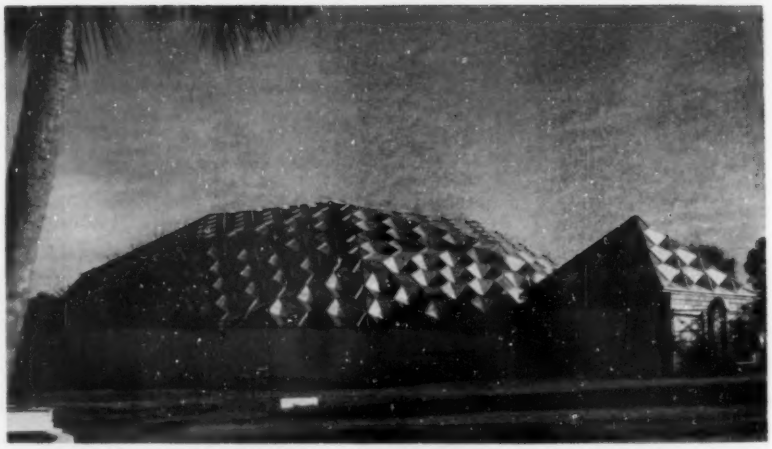


● **COVERS for the trickling filter and dosing tank at the Sarasota, Florida, sewage treatment plant are fabricated from interchangeable aluminum and stainless steel components. The treatment units were covered to insure complete control of odors.**

WIDE SPAN "SPACE FRAMES" COVER TRICKLING FILTER

SPECIALLY fabricated covers have been installed on two units of the Sarasota, Florida, sewage treatment plant, in connection with the city's air pollution control program. The covers, known as "Shell Truss" Space Frames, are made entirely of stainless steel and aluminum, fabricated to aircraft tolerances.

Specifications were drawn up by Smith and Gillespie, Consulting Engineers of Jacksonville, but design limitations were open to take advantage of new techniques. The contract was awarded to Jeffrey Lindsay and Associates of Montreal and Los Angeles. Special consultant was Dr. Richard Pomeroy of Pasadena, California.

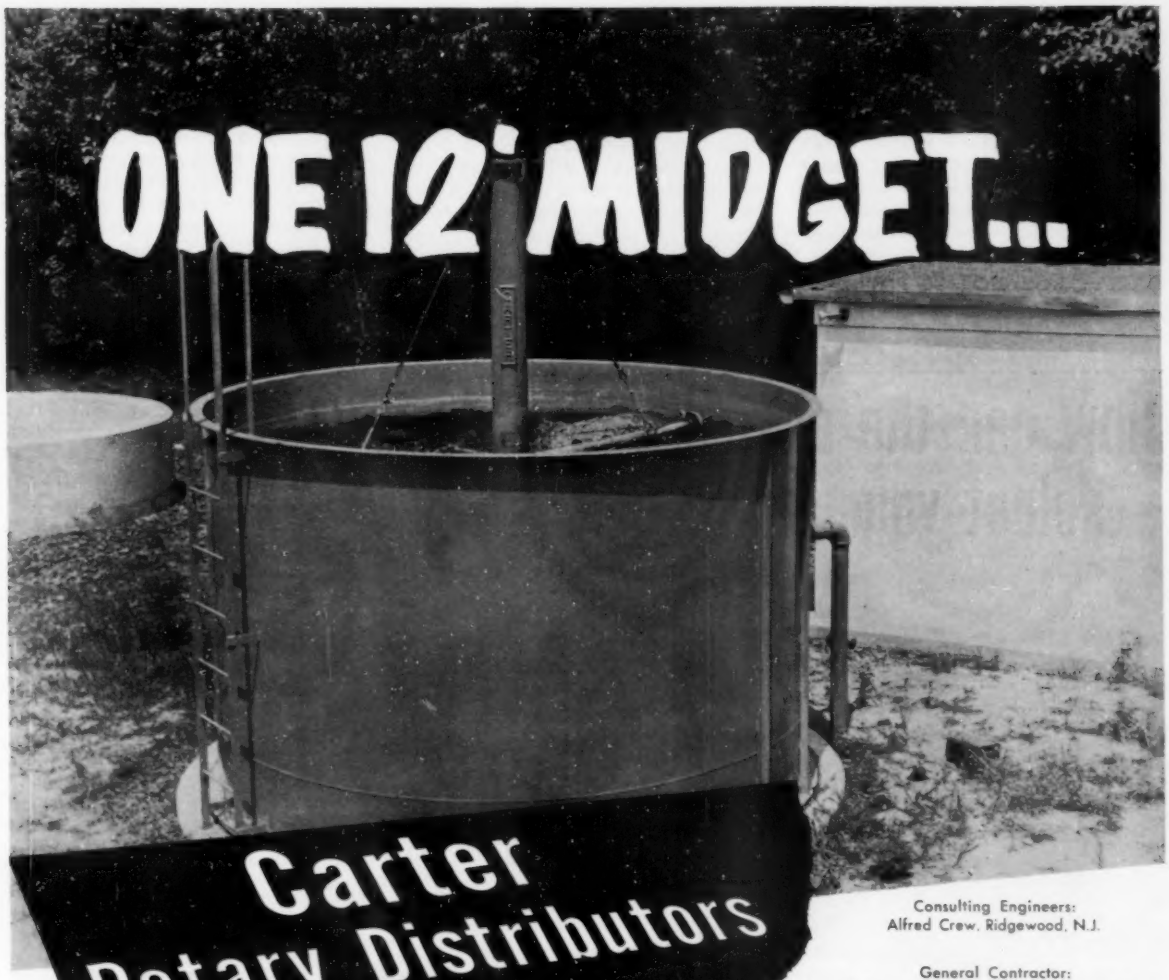
Identical components were used for the two covers, one a dome and the other a pyramid. Any size cover can be made up with the space frame kit, and extra reinforcement of the concrete tank wall is not necessary. The frames bolt to special expansion brackets, which in turn are bolted to the wall. Personnel hatches provide access, and larger maintenance openings are readily available by removing entire panels from anywhere in the structure. Such panels have approximately 28-ft. edge measurement, are 285 sq. ft. in area and weigh 300 lbs.

As installed at the Sarasota plant, the dome is 112 ft. in diameter by 27 ft. high and covers 10,000 sq. ft. with 12,000 sq. ft. of space frame. The pyramid is 24 x 24 x 12 ft. and covers 500 sq. ft. with 800 sq. ft. of space frame. Total cost of both covers in place was $39,500 or $3.08 per sq. ft. of space frame complete.

A notable feature of the "Shell Truss" system is that various plastic liners can be installed to isolate corrosive fumes. In the case of the Sarasota tank covers, a Type 1 "Osmoticloth" (silicone-treated Dacron) is used. The material is highly resistant to both H_2S and H_2SO_4. A blower draws air through the porous liner and passes it down through the filter bed where hydrogen sulfide and other offensive compounds are oxidized. Passage of air through the liner helps to keep it dry, further inhibiting the surface formation of sulfuric acid from the hydrogen sulfide in association with water vapor.

The City of Sarasota has become the first municipality to accept this new technique, which is competitive in price and carries performance guarantees. City officials state they are well pleased with the new structures installed at the sewage treatment plant.

Other potential applications of the "Shell Truss" are in the construction of public swimming pool enclosures; gymnasiums; bulk storage; and, in fact, for all buildings for which large clear volume space and span are mandatory.



Consulting Engineers:
Alfred Crew, Ridgewood, N.J.

General Contractor:
DeForest Construction & Equipment Co.
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Midget Rotary Distributors Find Widespread Use in Miniature Trickling Filtration Plants

The current trend toward dispersion of suburban shopping centers, hotels, motels, highway restaurants, and other commercial establishments has served to emphasize the importance of the role being filled by small treatment plants—in solving problems of domestic sewage discharges outside the reach of municipal sewerage systems. This increased emphasis on efficient handling of low flows has resulted in equipment specifically suited to the small treatment plant . . . equipment such as the 12' Carter Rotary Distributor shown here in a typical miniature primary plant handling wastes from a busy highway restaurant.

In every respect, these midget units receive all the care and skill that goes into major equipment. Proven designs, skillful fabrication and precision machining of all vital parts . . . reducing hydraulic losses to a minimum . . . and assuring continuous, troublefree operation under low head conditions. Everything is made as simple and fool-proof as possible, so that operational and maintenance requirements can be handled by even unskilled personnel.

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Fire Protection Without Water Mains

TWO SMALL MID-WEST towns have facilities for getting water for fire protection even though they do not have water systems. The systems used are described in some detail in the Johnson National Drillers' Journal. The two towns are Dousman, Wisc. and Gulfport, Ill. They provided themselves with water for fire protection by putting in a number of well-point systems at strategic points. These tap underground reservoirs in the form of fairly thick strata of water-bearing sand.

Each system consists of several well points connected to a common header pipe. The header is laid below the ground surface. A central connection to the header extends upward to a convenient height above ground and this constitutes the hydrant. It is fitted with a standard connection to hook up to the suction hose of the pump on the fire truck. Use of the systems is reserved for the fire department only.

Dependability of a well point system for this application rests upon three factors: An efficient installation; a saturated water-bearing sand with fairly high permeability; and a water table within 10 or 12 feet of the ground surface. Periodic pumping to check performance is a necessary routine to be sure that each "hydrant" is always ready to supply the flow needed.

In one sense, these installations are more dependable than fire hydrants connected to water mains. The well systems will deliver their full yield of water to fight fires even if the town should suffer complete failure of its electric power system.

Dousman installed its first fire-protection well systems almost 20 years ago. For each installation, 20 well points, three feet long, have been sunk to a depth of 24 feet. The well points and risers are located on 8-foot centers. These are all connected to a four-inch header pipe 3 ft. below ground surface.

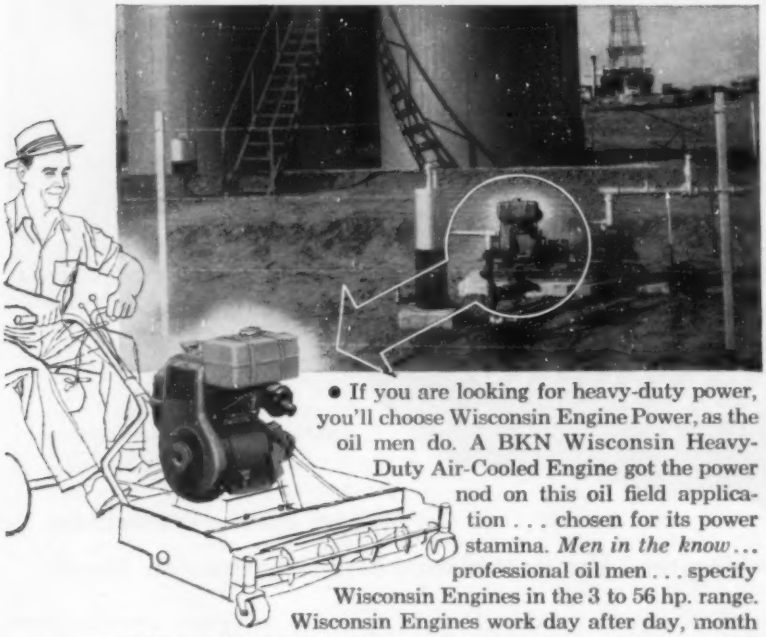
Yields Up To 450 GPM

The first installation of Dousman had a maximum yield of about 300 gpm. However, later installations, in which continuous slot well screens have been employed, give better performance. Each system constructed with 20 continuous slot well points will supply the full capacity of the fire-engine pump, which is 450 gpm. The maximum possible yield from each system is even greater than this since the pump has never broken suction when pumping any of the newer installations at 450 gpm.

Last winter a serious fire in the business district required the pumping from all four systems simultaneously. They were pumped continuously for 12 hours while fighting the blaze. There was no trouble at any time obtaining a sufficient supply of water.

Gulfport, Ill., put in twelve hydrants recently, each of which draws water from a group of three small wells. A supply of 300 gpm can be obtained from each hydrant over a prolonged period of pumping. The systems were placed at strategic points to enable effective fire fighting in any part of town. Gulfport population is between 300 and 400, about the same as Dousman.

How can the oil fields help you select your mower engine?



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You may never give your mower engine the punishing use that Wisconsin Engines absorb in the oil fields, but the Wisconsin Engine oil field record is the ultimate proof your mower engine will more than stand up under toughest conditions. 2,000 service stations back up Wisconsin Engines . . . several are near you.

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PUMPING 127' VERTICALLY AND 250' AWAY to drain 127' deep x 100' diameter riverside excavation for sewer pumping station. Pump is a Jaeger 10" diesel. Above it, a Jaeger 6" pump drains collector ring for the sheet-piled upper half of the hole.

135 LB. ALUMINUM DIAPHRAGM PUMP HAS PATENTED SPRING-BOTTOM BOWL: Often, an inexpensive 2" or 2½" suction hose is all you need with this light yet powerful 3" pump. Exclusive spring-bottom bowl is shock-absorbing and self-cleaning. Also built in 4" size.

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Base your pump buying on up-to-date performance data. See your Jaeger distributor or write for guaranteed actual performance of latest model Jaeger pumps in 1½" to 10" sizes.

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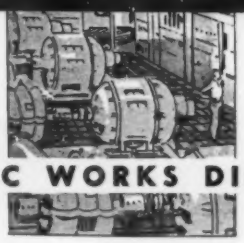


PUBLIC WORKS DIGESTS

Prepared by
ALVIN R. JACOBSON, Ph.D
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE WATER WORKS DIGEST

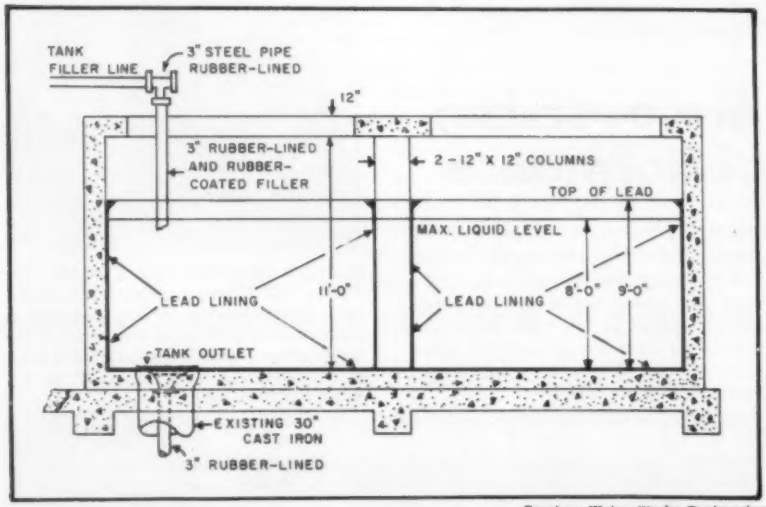
Save $12,000 Using Liquid Alum

By converting its coagulation practices from the use of dry alum to the liquid form, the City of Richmond, Va., has shown a saving of $12,000 per year in chemical costs, reduction in labor costs, and so forth. The first consideration given to the use of liquid alum was to the problem of storage of this corrosive chemical, a quantity adequate for at least seven days' operation at maximum output of water, both for the present and future needs. An old wash water tank 28 feet wide by 43 feet long and 11 feet high was lead-lined using 10 pound lead to a height of 9 feet. An outlet arrangement was provided on the liquid alum chamber through redesign of the cast iron pipe originally leading to a venturi meter for measuring wash water. A 3-inch rubber-lined pipe is used to fill the tank directly from the tank truck at the loading platform. This eliminates about 20 man-hours of unloading formerly required for each 40-ton car of dry alum. After the concentrated liquid alum (specific gravity of 1.0355) is transferred to the storage tank it is diluted with water before being fed into the raw water by gravity feed. The only pumping required is during the delivery of liquid alum to the plant from the tank truck. The City of Richmond purchases about 1200 tons of liquid alum on a yearly contract basis at a savings of $10 per ton over dry alum, making a yearly savings of $12,000. Elimination of extra work of unloading alum has made it possible to hire one less man at a further saving of $3,300. Further savings have resulted from the elimination of wear and tear on pneumatic unloading equipment and dry feed machines that were not operated due to the change to liquid alum.

"Conversion from Dry to Liquid Alum Saves $12,000 Per Year at Richmond." By Willard W. Anders. *Water Works Engineering*, January, 1958.

Calcite in Water Treatment

In the treatment of practically all water supplies it is necessary to apply some alkaline reagent for the following two reasons; namely, (1) to raise the alkalinity (where deficient) to a point sufficiently high to provide effective coagulation; and (2) to raise alkalinity and pH, where it is necessary, of the finished waters (well or surface) for the purpose of inhibiting corrosion. The author has provided a discussion of the basic chemistry involved in the solubility of the mineral constituents from the soil which comprises the alkalinity of the water being treated. The alkalinity varies from water supply to water supply and also in the individual supply, especially surface supply. Experiences are related as to difficulty of treating the raw water at Ossining, N.Y. The problems of color removal, providing effective coagulation and adequate control of corrosion had been very serious problems due to the inability to apply a greater amount of alkaline calcium salts, without objectionably raising the pH. To overcome this difficulty Calcite ($CaCO_3$), which is highly calcareous and crystalline, was substituted for lime as an alkaline reagent. The Calcite was added to a strong solution of alum in a crock and the combination thoroughly agitated to prevent the reaction to go to completion. Then the chlorine discharge hose from the chlorinator was attached to the crock and the strong chlorine solution permitted to react with the Calcite to form a type of hypochlorous acid or alkaline hypochlorite. The investigations at Ossining, using this combination of Calcite and alum and chlorine in one solution gave considerable indication of improvement of floc formation and sedimentation over that which was normal with the conventional treatment with alum and lime. The operating results were considered sufficiently promising to serve as a basis for design of all chemical feed and flocculating units at the Oneonta, N. Y., plant. The overall results of this method of treatment at the new plant are superior coagulation, and excellent color, turbidity and iron removal. Calcite dosage in the range of 25 to 75% of the alum dosage is effective in producing a better floc, although 50 to 75% seems to be



Courtesy Water Works Engineering

● **SPECIAL lining materials protect liquid alum storage tank at Richmond, Va.**

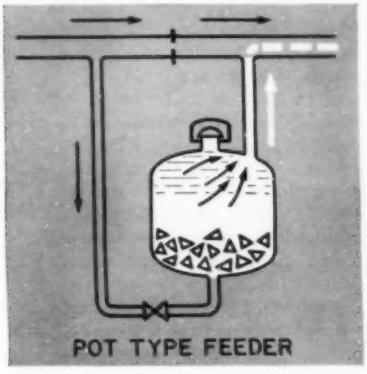
Chemical Feeders

Practically all water-treatment systems include addition of chemicals for one or more purposes: as coagulants to adsorb color, organic matter, oil and turbidity; to raise or lower pH; for lime softening; to inhibit corrosion; to kill bacteria; to adsorb tastes and odors.

The method of feeding the chemicals depends on the kinds used and on the volume, accuracy and proportions required. In general, solution feeders are used for smaller dosages and chemicals which can't be fed dry; dry feeders for large dosages. Here are some of the most-used types of feeders:

Pot type feeders

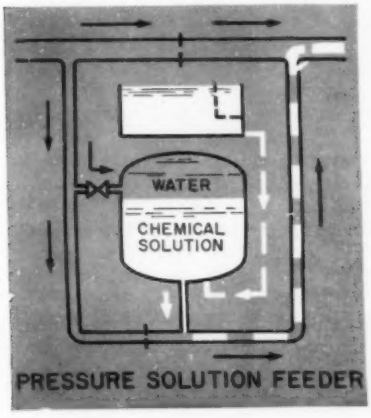
These are used for slow-dissolving chemicals in crystal or lump form (alums, sal soda, etc.) or special briquets. The chemical is placed in the feeding pot where it is dissolved by by-pass water flowing from the high-pressure side of an orifice to the low-pressure side. Since this flow is proportional to the main flow, the amount of chemical fed is proportional. Variations in amount and solubility of the chemical can, however, affect the feed rate.


POT TYPE FEEDER

Pressure solution feeders

These allow use of lower cost chemicals (aluminum sulfate, soda ash, etc.) than pot type feeders and provide more accurate control. The chemical is dissolved in the open tank. When needed, the solution is charged into the bottom of the pressure tank, and the displaced water, being lighter, flows out the top to waste. A sight glass float shows the level of the chemical solution in the pressure tank. When on the line, the feeder feeds from the bottom.

Note that solution feed is into a by-pass circuit instead of directly into the raw water line. This eliminates a long vertical run of undiluted solution which, because of its greater weight over the water in the circuit, could affect proportional feeding accuracy.



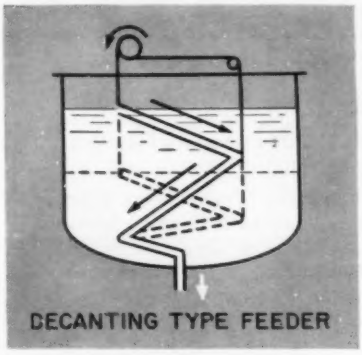
PRESSURE SOLUTION FEEDER

Gravity orifice feeders

A solution of known concentration flows through an adjustable orifice under constant head to provide the desired rate. For intermittent feed, a solenoid valve on the orifice discharge line is operated simultaneously with a raw water pump. Low in cost but limited to constant water flow rates and clear solutions that will not clog the orifice.

Decanting type feeders

This type is known as Permutit Electro-Chemical Feeder. A swing draw-off pipe is lowered at a speed that draws off solution at the desired rate. Feeds practically any type of solution or slurry used for water treatment.


DECANTING TYPE FEEDER

For proportional feeding, a water meter operates a timer that starts the feeder motor which lowers the draw-off pipe for a pre-set period. The timer controlling the lowering rate is easily adjustable allowing wide flexibility and accurate control. Rugged construction. Available with mixing propeller and with cover and dust evacuator.

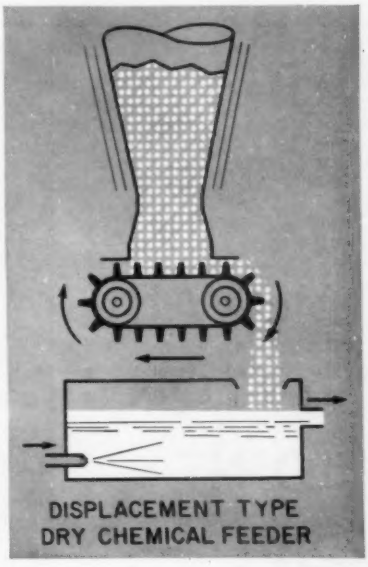
Reciprocating pumps

Pumps with adjustable length of stroke are widely used as feeders . . . generally operated by a meter and timer. Since volumes fed per stroke are uniform, feeding is accurately controlled.

A duplex or double pump feeds one solution to 2 or more points . . . or 2 or more solutions to the same or different points . . . in adjustable proportions.

Dry chemical feeders

A displacement type dry feeder eliminates batch weighing or measuring of dry chemicals and delivers a constant flow of accurately measured amounts of dry chemical (by volume) to a mixing chamber through which water flows at a sufficient rate for good mixing and to prevent settling.


DISPLACEMENT TYPE DRY CHEMICAL FEEDER

The chemical is discharged from a vibrated hopper onto a moving belt with lugs which "slice" off equal, exact volumes of the dry material. The belt speed is adjustable to deliver from 0 to hundreds of lbs. per hour by simple setting of a stepless speed changer. Adjustable while feeder is running, if required.

The feeder can be designed for constant rate feed or, with a meter and timer, for proportional feeding. Feeds practically any type of non-deliquescent dry powder or granules. Can be equipped with counter to show cumulative amount of chemicals fed.

• • • •

For complete details on feeders or other types of water-conditioning equipment, write: The Permutit Company, Dept. PW-3, 50 West 44th Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., Toronto 1, Ont.

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optimum. Floc formation is excellent at pH ranges as high as 7.3 and slightly above. Another device employed further to aid the formation of floc is through a feed-back system which returns about 20% of heavily flocculated water from the end of the third flocculating bay to the entrance end of the first bay. It seems that many existing well-designed water treatment plants may use the Calcite alum process to operate at higher than normal ratings. This process may also improve the efficiency of sedimentation of many upflow clarifier units that were designed with detention periods which are too low or conversely with upflow rates which are too high.

"Calcite in Water Treatment." By Thomas M. Riddick, Norman Lindsay, and Antonio Tomasi. *Water and Sewage Works*, January, 1958.

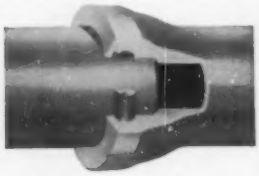
Membrane Filter Standard

The Executive Committee of the AWWA Board of Directors approved unanimously on November 7, 1957 the application of the membrane filter procedure as an alternate to the MPN procedure in the laboratory examination of water for coliform bacteria. This official action was taken upon the unanimous recommendation of the Officers ot the Water Purification Division that members of AWWA in responsible charge of laboratories having to do with the production of water for public use consider themselves at liberty to use the membrane filter procedure, provided (1) that the laboratory administrator has satisfied himself by comparison tests that the membrane filter procedure produces results which are essentially equal to the completed test, and (2) that the state sanitary engineering laboratory approves the application of the membrane filter procedure to public water supplies under its jurisdiction.

"Acceptance of Membrane Filter Procedure." A Report of AWWA Action. JAWWA, January 1958.

Odor Control with Chlorine

The water supply at McNeil Island, Washington, is impounded in two reservoirs, the main one which holds approximately 700-million gallons and the lower one which holds approximately 25-million gallon capacity. During the spring and summer months the main treatment problems are the removal of color, iron, manganese, and certain odors which are caused by algae, principally *Anabaena*. The control of odor is not attempted in the large upper reservoir, but consists of treatment with copper sulfate in the small lower reservoir when needed. Because of the high organic content, the water actually becomes septic toward the bottom of the reservoir. High concentrations of iron, manganese and odors are present, together with an absence of oxygen, in this area of the storage reservoir. In the upper 3 ft. the highest concentration of algae are present resulting in a condition of oxygen supersaturation, but the odors are almost as bad as at the bottom. Chlorine demand tests are performed routinely. These tests show a series of plateaus instead of a breakpoint. The water is chlorinated to the level at the end of the first plateau. If the odors persist at the hot-water tap (80°C.), the chlorine concentration is increased to the level at the end of the second plateau, and so on until odors do not persist. With this method, all swamp or algae odors can be destroyed. Chlorine odors, however, still persisted at the cold water tap. Aeration was tried on the treated



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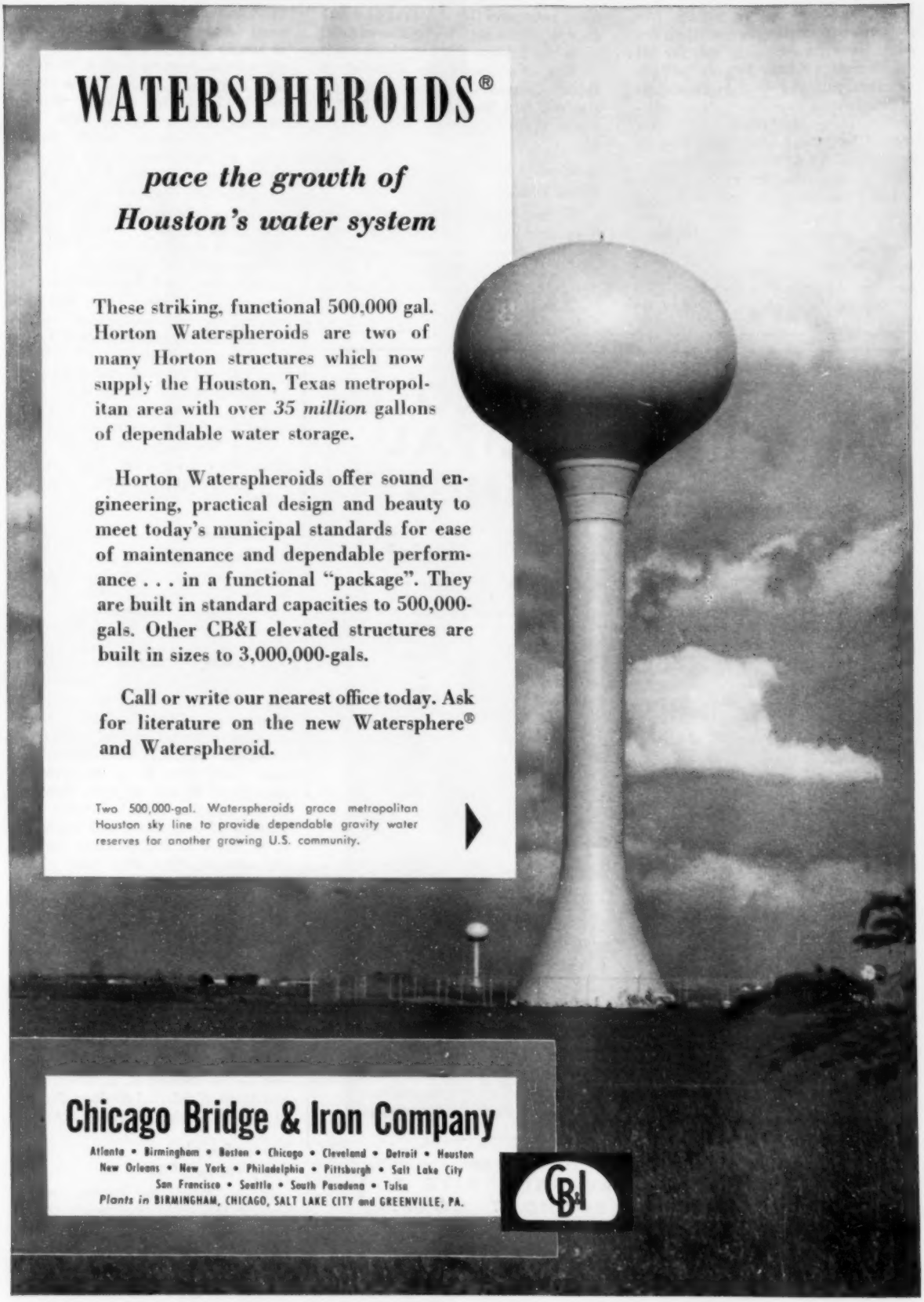

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water and the odor no longer was present. It was also cheaper than the addition of lime or soda ash for pH adjustment. Further tests in the laboratory and in the treatment plant showed that the high concentrations of manganese could be removed by means of chlorine dioxide at a pH of 5.8 to 6.4 which is necessary to remove the color. Sodium chlorite solution is added to the solution chamber of the chlorine feeder, the dosage varying between 10 lb. to 20 lb. per million gallons, depending on the manganese present for complete removal. Added advantages are clean filters, long filter runs, and the removal of manganese in the settling basins instead of in the filters.

"Use of Chlorine for Control of Odors Caused by Algae." By Ray Harlock and Rae Dowlin. JAWWA, January 1958.

Guided Missiles Need Water

An unprecedented growth in population in the City of Cocoa, Florida, resulting from the establishment of the Guided Missile Training Center nearby, and the Patrick Air Force Base and the missile proving ground at Canaveral brought about the need for locating a suitable source of water supply. The existing supply was inadequate both as to quantity and quality. In 1955 a search was instituted for suitable well locations and in June, 1956, well drilling operations were started about 30 miles west of the city limits of Cocoa. A total of 9 wells will be required, each yielding about 750,000 gallons per day, to meet the immediate future needs. Water treatment facilities include aeration for removal of hydrogen sulfide, chlorination, and fluoridation. Provisions will be made for corrosion control by pH adjustment or the addition of polyphosphates if future operations indicate that it will be necessary. Complete automatic supervisory control has been provided for all well pumps and the distribution system pumps.

"New Water Supply Requires 30-Mile Pipe Line." By Theodore B. Jenson. PUBLIC WORKS, February, 1958.

Virus Removal By Flocculation

The recent outbreak of waterborne infectious hepatitis in New Delhi, India, challenged the adequacy of modern water treatment processes. In an effort to evaluate the efficiency of flocculation and coagulation processes in removal of bacterial and Coxsackie viruses, suspensions of the viruses were flocculated in the laboratory with doses of alum, varying from 40 to 120 ppm, and with ferric chloride, at dosages of 20 and 40 ppm. Removal of the viruses varied directly with dosages of coagulant, and amounted to as much as 99.8 percent removal of bacterial virus at a dose of 100 ppm alum. The optimum pH range for alum coagulation of the virus suspensions was found to be 6.2 to 7.2. Ferric chloride was more effective than alum; at dosages of 40 ppm each, alum removed 86.3 percent of the Coxsackie virus, while ferric chloride removed 98.1 percent.

"Removal of Coxsackie and Bacterial Viruses in Water by Flocculation." By S. L. Chang, R. E. Stevenson, A. R. Bryant, R. L. Woodward, and P. W. Kabler, *American Journal of Public Health*, January, 1958.

Water Supply Progress in 1957

In this article the author has reviewed the accomplishments of the water works industry during the past year. Many of the problems confronting the industry have been discussed by citing individual com-

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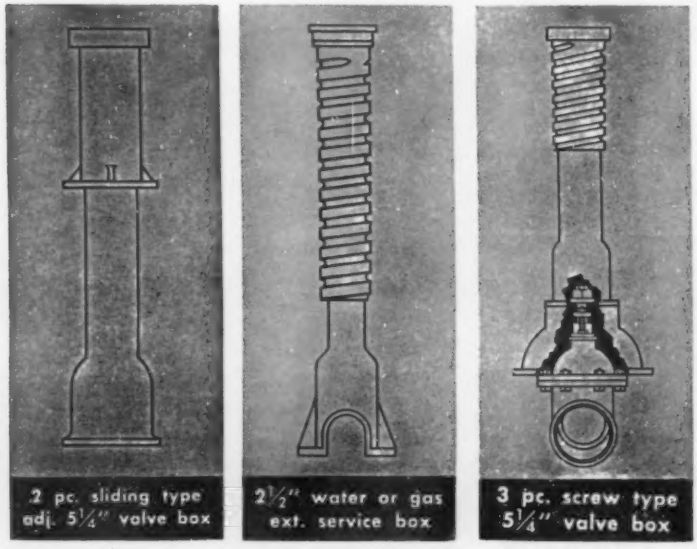

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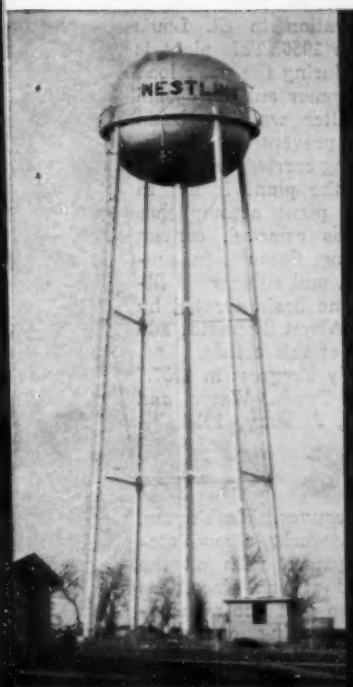
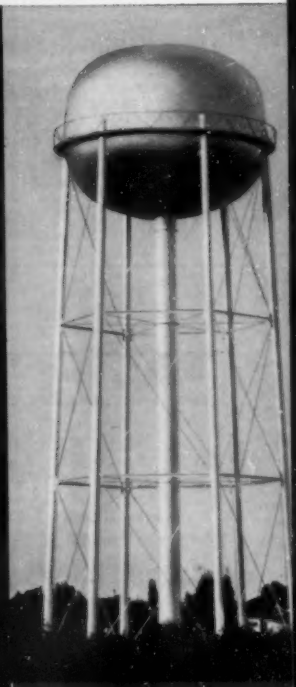


WICHITA
100,000 Gallons
Head Range 21'01"

OLATHE
250,000 Gallons
Head Range 30'10½"

WISCONSIN

RACINE
150,000 Gallons
Head Range 24'9¾"



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munities and their approach to the solution of the problem. These include the problem of an adequate supply, many communities having been plagued with serious drought and a falling ground water table. Many communities, for the first time, are paying more attention to the adequacy of their water supply both as to their present and future needs. The AWWA and various local sections of the AWWA are cognizant of this problem and are taking the lead in informing the public as to these needs. Specific developments in methods and equipment are cited. A partial listing includes the following: 1) A chlorinator that automatically adjusts the rate of feed to compensate for changes in chlorine demand; 2) a Dorrclone desanding system for well supplies that are continuously yielding quantities of sand; 3) a steel bridge constructed over a river to carry a 42-inch standard mechanical joint cast iron pipe. Several other less significant examples are shown by photographs. Two innovations in design are of considerable interest. One is the use of asphaltic concrete as a waterproof deck on the upstream face of a rock-filled dam at Colorado Springs. It is a relatively low cost material that will provide a flexible waterproof deck which should not crack resulting from movement under load and settlement of the fill. The other innovation pertains to the auxiliary water treatment plant of novel design placed in operation in St. Louis County, Mo., in 1956. This plant is operated only during the peak load period each summer and its design provides for filter washing, basin cleaning, and preventive maintenance work being carried out during periods when the plant is not in operation. The plant accomplishes suspended solids removal, contact softening, settling, flocculation, secondary settling, and submerged filtration all in one basin created by earthen dikes. About 30 photos add to the interest of this article.

"Water Supply Progress in 1957." By Lewis S. Finch. *Water and Sewage Works*, January, 1958.

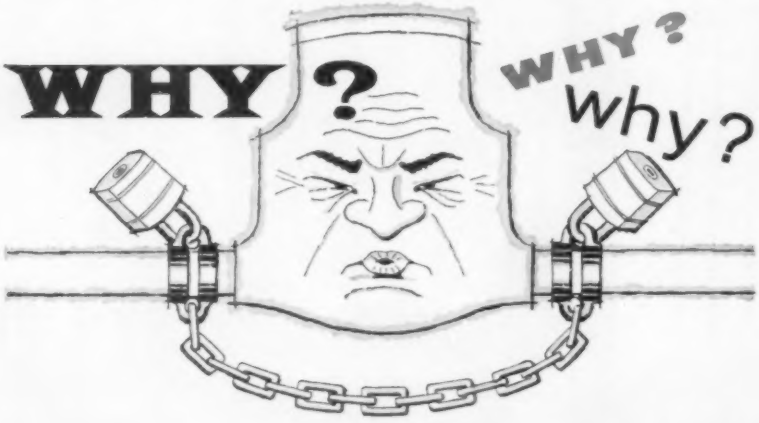
Automatic Controls

At the Vancouver, Washington, municipal water works, a completely automatic system, with all the controls located at one place, has been installed so that one man coordinates all pumping operations and controls the water levels in the underground and elevated storage reservoirs on the distribution system. Before the installation of this equipment five men were necessary to check the four ground level reservoirs, the four elevated tanks and the pumping stations. The new system requires no radio tubes, electronics, or radio frequencies but includes a transmitter, receiver, and recorder all in one separate circuit. The transmitter operates from the reservoirs, controls all pumps, transmits the water level signal to the main station and also operates the recorder at the main station. The receiver at the pump house is synchronized with the timer at the transmitter. Recordings are made of water levels at reservoirs, the number of pumps in operation, which pump is in operation, and trouble, if any, and its location. Over the past four years these controls have more than paid for themselves.

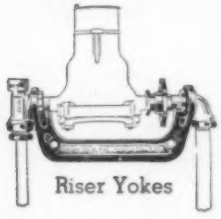
"Electrical Supervisory Controls Check Water System." By Marvin H. Schroeder. PUBLIC WORKS, February, 1958.

Improved Water Facilities

Manhattan, Kansas, has been faced with repeated water demands exceeding 5 mgd from a plant with a rated capacity of 4.5 mgd. These



SHACKLE YOUR WATER METERS?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demands resulted in the present improvement program. The first big improvement was construction of a 500,000-gallon elevated storage tank. A new well with an 18-inch main from the wells to the treatment plant was also completed, together with approximately 3 miles of 16-inch distribution mains from the treatment plant over to Kansas State College, where a 10-inch line was stubbed out for the college hookup and a 12-inch line extended to the new elevated tank. The existing high service pumps were replaced with new units having a capacity of 8.5 mgd in a new high service pump house constructed over one corner of the new 1,000,000 gallon underground storage reservoir. The new elevated and underground tanks increase the treated water storage capacity to over 4,000,000 gallons. Expansion of the treatment plant capacity included construction of four rapid sand filters with Leopold bottoms and a new aerator unit, another slow mix basin and a new settling tank. In addition, the bottoms in the four oldest filters were replaced, and the sand was replaced in six filters. The two existing aerators and rapid sand filters were enlarged. Two Walker Carball recarbonation units were installed to produce a stable finished water of good quality. Total cost of the improvements to date approximates $1,170,000.

"Manhattan, Kans., Improves Water Facilities." By R. E. Boone. *The American City*, January, 1958.

Other Articles

"Nomographic Charts Aid in Design of **Zeolite Water Softening** Units. By Rolf Eliassen and E. Alan Cassell. Water Works Engineering, January, 1958.

"Chain of **Interlocked Reservoirs** Bolsters Borough's Water Supply." By Melvin H. Diven. Water Works Engineering, January, 1958.

"Criteria to Consider When Supplementing **Fluoride-Bearing Water.**" By David F. Striffler. American Journal of Public Health, January, 1958.

"**Two-Way Radio** Communication Boosts Service 50 Percent." By Walter Rudolph. Public Works, February, 1958.

"Trends in **Air-Conditioning Use** and Regulation." A Report of Committee 4130M—Water Use in Air Conditioning and Other Refrigeration, Elwood L. Bean, Chairman. Jour. AWW Ass'n, January, 1958.

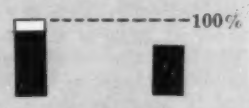
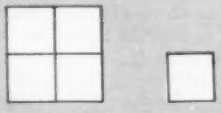
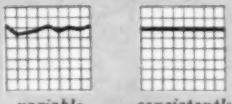
"Water and Sewage **Facilities for the Kansas Turnpike.**" By P. Clifford Sharp. Jour. AWW Ass'n, January, 1958.

"**Defluoridation** of Water With Activated Alumina." By Emilio A. Savinelli and A. P. Black. Jour. AWW Ass'n, January, 1958.

Interesting Comparisons

For Men Faced With Increasing Demands on Municipal Water Supply

Since increased water supply frequently demands increased filtration capacity, these considerations are important to many municipal engineers.

RAPID SAND FILTRATION	DIATOMITE FILTRATION	
	100%	**capital investment** Based on the actual costs of existing municipal diatomite filtration systems as compared with engineering estimates and bids for equal capacity sand bed systems for the same municipalities.
		**space requirements** A conservative estimate, since a diatomite filter which will deliver 300 gallons per minute may occupy no more than 20 sq. ft. of floor space. On large installations, this differential may be as high as 10 to 1.
 *variable*	*consistently brilliant*	**clarity** Because diatomite filtration is a "micro-straining"—a mechanical process—its positive action is more dependable than the uncertain effectiveness of floc formation with coagulants as used in rapid sand units.
partial	complete	**activated carbon removal** Diatomite filtration is the only commercially practical system which removes all trace of activated carbon used to adsorb undesirable taste, odor or color.
can be serious	0	**air binding difficulties** Independent tests made by municipal engineers, using water supersaturated with oxygen, showed no appreciable effect on the efficiency of a diatomite filtration system.
up to 10% of previous run	*a few gallons*	**water required for backwashing** Reports from many municipalities show that from 2% to 10% of the previous filter run is required to backwash the sand bed.
$ = $		**operating costs** This may be considered as an "average"; individual circumstances set the actual costs in any specific installation.

Dependable GLC Great Lakes Dicalite Diatomaceous Materials

Dicalite Bulletin 8W-13 contains much information on Dicalite filtration of potable water—clarity, purity, bacteria removal (95% or better) together with data and operating figures on diatomite filtration systems now operating in certain municipalities. Write for it—it's free.

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Great Lakes Carbon Corporation
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for better performance—lower operating costs...

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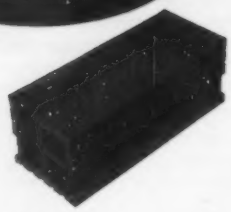
FILTER BOTTOMS



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Leopold

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Zelienople, Pa.

Municipal Water Softening

(*Continued from page* 105)

less, then practically all is present as hydrogen sulfide; but at a pH of 7.5 only 17 percent and at a pH of 8.0 only 6 percent.

If enough acid were added to the water to depress the pH to around 5.0, the total sulfide content could be removed by aeration. However, with most waters this would be a very expensive process, and the pH of the aerated acid water would need some rebuilding. Instead, treatment for sulfur waters is: first, aeration, preferably with a forced draft aerator, such as the degasifier; second detention; and third, chlorination. As regards aeration, there are two factors involved which work in opposite directions: as hydrogen sulfide is being removed, more of the fixed sulfide changes to hydrogen sulfide to re-establish the equilibrium; and since hydrogen sulfide is more soluble than carbon dioxide, the carbon dioxide tends to come out faster than the hydrogen sulfide. This raises the pH value and tends to bind more of the sulfur in the "fixed" form as an alkaline sulfide.

Some oxidation of the hydrogen sulfide is effected by the aeration, but this is usually a rather slow reaction which continues in the basin or reservoir into which the aerated water is discharged. Probably, there is some further oxidation to a sulfate but this second reaction is very much slower than the first and elemental sulfur is usually evident in the basin or reservoir. In many cases, sulfur bacteria have an important part in the removal of sulfides and stringy white growths of them occur in the aerator and the aerated water.

Chlorination is effective in oxidizing sulfides and the reactions are very rapid. It is therefore widely used for removing sulfide residuals and is equally effective on raw waters but unless the hydrogen sulfide content is low, the cost is excessive, since the oxidation is largely to the sulfate, instead of to water and sulfur. Also, it is impossible to avoid much of this complete oxidation to sulfate even when insufficient dosages of chlorine are added, for in such cases, part of the sulfide is completely oxidized and part is not oxidized at all. The pH value affects the amount of chlorine consumed as shown by some experimental work by the author and E. K. Gilbert in which the total sulfides were 5 ppm (expressed as H_2S); the chlorine dosage was 50 ppm; and the detention period was 10 minutes. The theoretical amount of chlorine consumption for complete oxidation to sulfate of 5 ppm of hydrogen sulfide is 42 ppm. However, the oxidation of the sulfides consumed from 44 ppm to 25 ppm of chlorine while the oxidation to water and sulfur would only have consumed 10.4 ppm. It is evident that at pH values below 6.5, practically all of the sulfide was oxidized to sulfate; at a pH of 7.1, about 70 percent was oxidized to sulfate; and that at a pH of 9.0 to 10.0 almost 50 percent was oxidized to sulfate.

With most sulfide waters, more than enough alkalinity is present to neutralize the sulfuric and hydrochloric acids formed in the reactions between chlorine and H_2S. The net result is only a slight increase in the chloride and sulfate content, a corresponding reduction in the alkalinity, and a slight lowering of the pH value. This, of course, applies where the residuals to be removed are rather small and, as previously mentioned, chlorination is rarely used on any but aerated waters or waters with a very low content of hydrogen sulfide as the removal costs otherwise are high.

Occasionally, well waters which are free from sulfides when drawn, may develop sulfides in the distribution system due to sulfate reducing bacteria which reduce a small portion of the sulfates to sulfides. Some of this water, especially from dead ends, may be black from colloidal ferrous sulfide formed by the corrosive action of the sulfides on the iron pipe of the distribution system. The amount of ferrous sulfide producing this black color may be surprisingly small, for the color of colloidal ferrous sulfide is very intense. The remedy, of course, is chlorination of the water supply which effectively eliminates the bacteria and their sulfate reducing activities.

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Columbia Water System

(*Continued from page* 89)

and will be adequate until 1966. At that time a booster pump will be installed on the other standpipe, and when complete these will raise the total storage to 17 mg.

In 1968 the water plant is to be expanded, with a 3-mg ground storage unit, which will increase the total storage to 20 mg, which should be sufficient until 1978.

The calculations for the Eau Claire system will not be presented, but they may be summarized in the recommendation that the two systems should be combined. In Figure 2, the saving in storage capacity and in cost, is shown, considering the two systems as one.

For the improvements to be undertaken now the cost will be $530,000 for two 4 mg steel standpipes with foundations, $10,000 for sites, $75,000 for a pumping station, $30,000 for a control valve and $51,000 for engineering and administration. The total cost for the complete installation, present and in 1966, is estimated at $747,360.

Air Conditioning and Sprinkling

Peak demands are compounded of extra quantities used for lawn sprinkling and air conditioning. The effect of these on total consumption is shown in Figure 3, made up from data compiled for two contrasting days. June 27, 1956 was a hot, dry day. For six days preceding the temperature stood above 100°. There had been no rain. Water was used in excess of pumping—taken from elevated storage—in two periods, from 7 am to 1 pm and from 5 to 8 in the evening. On August 23, 1956 the temperature was 87°, following two cool days in which 0.75 inch of rain fell. Little water was used for sprinkling and air conditioning was not up to maximum. The peak came in the middle of the day.

Generally the peak for sprinkling occurs about 7:00 pm. If each of the 21,000 houses were to use one sprinkler at the rate of 5 gpm, the rate of consumption at this peak hour on June 27 would have been approximately at the rate of 150 mgd, excluding any other consumption. The hourly maximum demand was at the rate of 43 mgd. The difference in demand between the two curves on that chart at 7:00 p.m. is at the rate of 28.3 mgd.

If it is assumed that all of this 28.3 mgd rate was for lawn sprinkling, the percentage of residential units using water at 5 gpm was 18.8. This bears out the conclusion of the engineers that a factor of 15 percent of residential units using water at the same time for sprinkling is reasonable.

It is difficult to pinpoint the amount of water used for air conditioning, but Columbia experienced an increase of 10 percent in consumption in the business district in the period 1950-55, before the city passed restrictions on use of water for this purpose. Recent checking of air conditioning systems having separate water meters showed that a maximum of 0.051 gpm is used per ton of connected water-type conditioners.

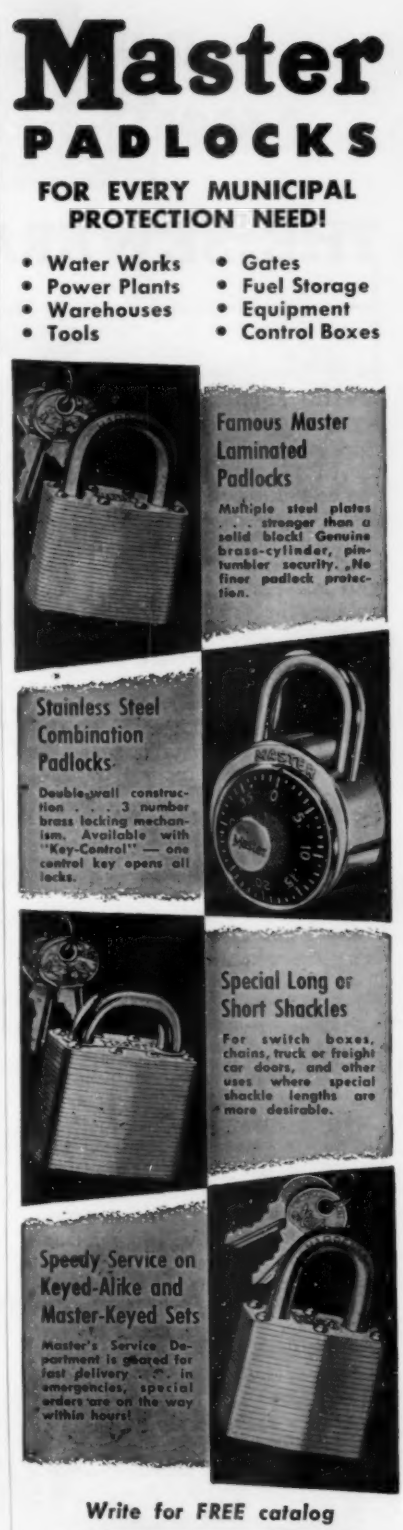
The engineers observe that in the last five years the dry-type systems have increased in size from 1½ to above 5 tons. As the dry-type units are made in larger sizes, there will be a decrease in the number of water using systems.

They observe also that one lawn sprinkler using 5 gpm is equal to a 50-ton water-type air conditioner with a cooling tower, operating at maximum summer temperature. It is evident, they conclude, that the major concern for future water supply will be lawn sprinkling and not air conditioning, and that the peak demand will come in the late afternoon or evening. At these hours the air conditioning load will be reduced as business buildings close.

Financing and Rates

The first increment in financing was the sale of bonds for $2,500,000. In the first stage of construction, financed by this issue, the flow of water will be increased from the present 28 to 36 mgd. Rates will be raised from 1.3 to 36 percent, based on consumption. There will be no increase in administration costs. Succeeding increments will require the sale of more bonds, to increase the supply with higher administration costs.

The South Carolina Revenue Bond Act limits the use of money obtained for such public improvements from bond issues to (a) operation and maintenance, (b) amortization, (c) contingent funds, (d) depreciation, and (e) surplus. All funds yielded by these issues authorized for stepping up the water systems are held in a utility account, and may be used for water and sewer improvement only.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PUBLIC WORKS DIGESTS

Prepared by
ALVIN R. JACOBSON, Ph.D.
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE SEWERAGE AND REFUSE DIGEST

Small Town Landfill Equipment

The Town of Chandler, Arizona, cooperated with the Public Health Service in conducting an investigation as to the practicability of using light equipment in sanitary landfill operations. These studies were devised to assist small communities with less than 10,000 population in making the best choice of light equipment available for excavating, compacting and covering household and light commercial refuse in a landfill. The crawler-type-tractor with front-end bulldozer or loader-type attachment was assumed as being the most practical type of light equipment for small communities. On the basis of drawbar horsepower and weight the light tractors were divided into 3 groups: Group 1 has 20-25 DBHP (drawbar horsepower), and 2-3 tons total weight; Group 2 has 25-30 DBHP, and 3-4 tons total weight; and Group 3 has 30-40 DBHP, and 4-8 tons total weight. A gasoline-powered tractor from Group 1 with a half-cubic yard bucket and a diesel-powered tractor from Group 3 with a bulldozer blade were evaluated in this study. The authors concluded that: 1) rugged equipment is required that will withstand the torques developed on the tractor frame in moving over the large solid objects present in city refuse; 2) the group 1 tractor was not sturdy enough for this type of work; 3) the operating costs of the Group 1 tractor used in this study were high because of the low rate of disposal and the repair costs, and 4) the Group 3 tractor equipped with a bulldozer blade performed adequately and appeared capable of handling 100 tons of refuse per 44-hour work week. It was also recommended that further critical testing of Group 2 tractors and other units should be made before broad conclusions can be made as to the most economical tractor for small landfills.

"Light Equipment for Small-Town Sanitary Landfill Operations." By Edward R. Williams, George F. Mallison and Paul P. Maier. PUBLIC WORKS, February, 1958.

Sludge Digestion

The experiments undertaken in this study were an attempt to find out what happens in the sludge digestion process at solids concentrations considerably higher than in normal operation of sludge digesters. In these laboratory studies it was shown that the production of volatile acids was the principal process in these concentrated sludges of 10 to 50 percent solids concentrations and that gas production decreased to zero after 6 days in

Tractor Shovel Handles Landfill on Part-Time Basis

REDUCED COSTS and increased efficiency of the sanitary landfill operation at Versailles, Kentucky, (population 3,000), is credited to new equipment by Lewis Boston, City Engineer. The entire landfill operation, from start to finish, is now handled by a Trojan rubber tired tractor shovel which is able to handle all the digging, stripping and trenching for the landfill.

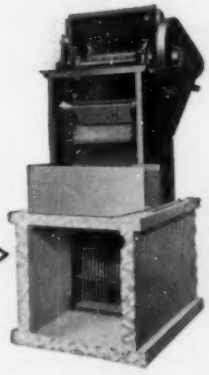
Since 1956, Versailles has been working its tractor shovel six, and sometimes seven, days a week. It works the landfill only four days a week, but in the course of a year it digs and moves approximately 31,000 cubic yards of material on this job. The rest of the time it works on water main jobs, on street construction and repair and in the city cemetery.

The city has been able to use the tractor shovel also for a "money-maker." The Trojan strips and loads the fertile, black earth found in a section of the landfill site, and the earth is sold by the city to contractors and residents. This material is excellent for dressing road shoulders and for gardens. Although the city uses some of this earth for its own purposes, over 90 percent of it is sold. The tractor shovel more than pays for itself through this one operation.

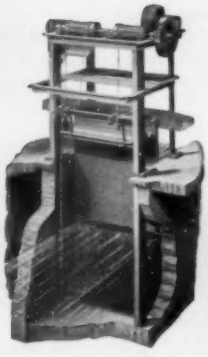
● **FERTILE black earth on the landfill site at Versailles, Ky., is sold to contractors and residents. This operation alone more than pays for the tractor shovel investment.**

Get waste treatment off to a safe start...with LINK-BELT screens

...for removal of large solids



THRU-CLEAN SCREENS. Automatic, chain-operated rakes clean from downstream side, are designed to eliminate jamming by debris. Vertical mounting minimizes friction between rakes and bars.



STRAIGHTLINE SCREENS. Automatic, cable-operated rake cleans from upstream side, assures clean, positive screenings removal. Easily accessible—no moving parts are mounted under water.

TRITOR SCREENS. Combined screen and grit chamber saves smaller plants the cost of separate units to remove large solids and detritus. Shredder for screenings can be provided, if desired.

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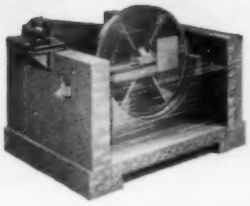
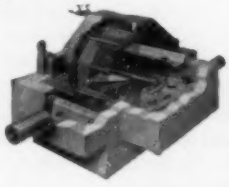
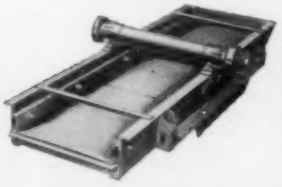
ROTARY DRUM SCREENS. Effectively remove fine solids from large volumes of water. These screens are best suited to installations where a fixed water level can be maintained.



LIQUID VIBRATING SCREENS. For thorough removal of fine solids from industrial liquids. High-energy vibration provides a relatively dry product with minimum blinding or clogging.



REVOLVING DISC SCREENS. For applications similar to rotary drum screens, but where volume is less. Simplified design contributes to ease and economy of installation. Very little maintenance required.



WHERE coarse or fine solids threaten to clog or damage subsequent equipment . . . where stream pollution must be prevented or valuable by-products can be recovered — efficient waste treatment begins with a Link-Belt screen. This broad line is your assurance of an impartial recommendation based on the specific nature of your waste. For full data, contact your nearest Link-Belt office or write for Book 2587.

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all batch experiments. Concentrations ranging up to 54,000 ppm volatile acids, as acetic acid, were reached at a dry solids concentration of 51 percent, after an 80-day period. Methane fermentation continued on at normal rates up to 37 percent solids, as long as the volatile acids were maintained between 1,000 and 2,000 ppm. It was confirmed by these studies that both processes, i.e., the methane fermentation and the formation of volatile acids, are operating simultaneously. Other interesting conclusions pertaining to sludge digestion and solids digestion within a sanitary landfill are summarized and discussed.

"Studies on Sludge Digestion and Methane Fermentation." I. Sludge Digestion at Increased Solids Concentrations. By K. L. Schulze on *Sewage and Industrial Wastes*, January 1958.

Aerobic Biological Treatment

The author has discussed several of the important factors essential to aerobic biological purification whether we are considering natural stream purification, the activated sludge process, or the trickling filter. The factors discussed in this article include nutrient requirements and the universal effect of nutritional deficiencies on growth characteristics. Algal photosynthesis has been analyzed in terms of its effect on oxidative purification processes. A number of excellent diagrams aid in the discussion of many factors essential to aerobic biological purification in this article.

"Universal Factors in Aerobic Biological Purification." By M. B Ettinger, *Sewage and Industrial Wastes*, January 1958.

Complete Small Treatment Plant

Dorr-Oliver has developed a complete sewage treatment plant that is capable of handling the wastes of up to 150 persons or their BOD equivalent. The new package plant, named the Comple-Treator, is a two-stage trickling filter plant consisting of an 11½-ft. diameter steel tank 20 ft. high weighing 25,000 lbs. The Comple-Treator consists of a Dorr Duo-Digestor surrounded by two stages of high rate trickling filters and two recirculation pumps submerged in respective wells. The unit does not incorporate a chlorinator, although one may be added. The installer need only provide a foundation pad, install filter underdrains, place 2 inch stone in the filter unit to a depth of 6¾ ft., and connect influent, effluent, and sludge lines and electrical service to place the unit into operation. Operating results on the 30 or more installations show BOD and suspended solids removals upwards of 90% for both. The new plant requires minimal operating attendance and may be installed for under $25,000.

"Complete Sewage Treatment Plant for 150 Persons." *Engineering News-Record*, January 16, 1958.

Rockland County's Sewage Plan

Rockland County, N. Y., located on the west bank of the Hudson River a short distance north of New York City, is preparing for the continuous growth of which it is virtually assured during the next few years. The County now comprises five towns and 11 incorporated villages with about 47% of the population (89,276 pop. according to 1950 Federal Census) being served by sewers. Seven of the communities operate primary treatment plants. The Town of Orangetown has two plants; a primary and a complete treatment plant. The Village of Spring Valley also operates complete treatment facilities. In addition, there are several institutions

Simple design and rugged construction are outstanding features of the double disc gate assembly in M & H Valves. The gate consists of 2 bronze faced discs, 1 integral stem nut and spreader, and 2 direct-acting bronze spreaders.

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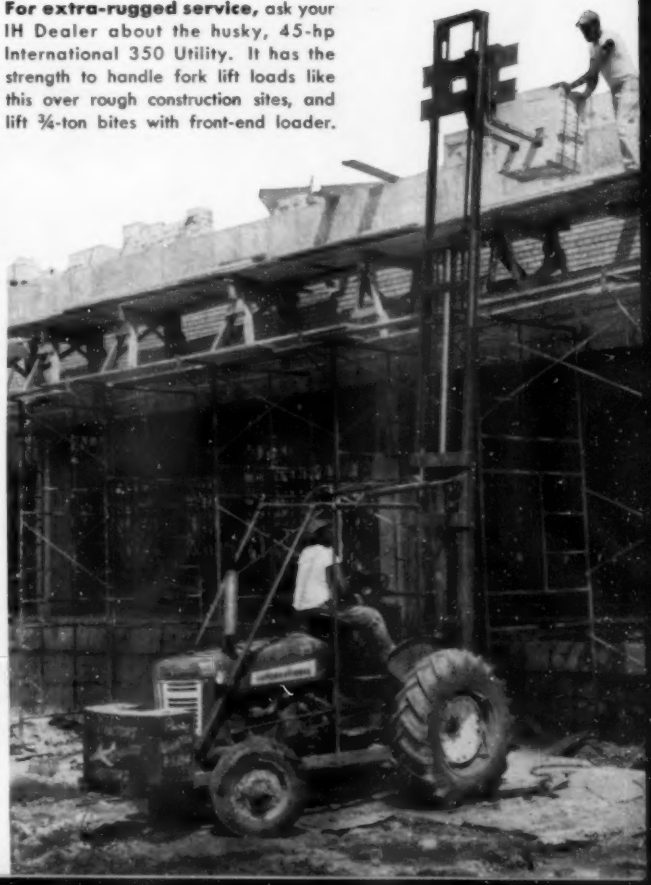
For extra-rugged service, ask your IH Dealer about the husky, 45-hp International 350 Utility. It has the strength to handle fork lift loads like this over rough construction sites, and lift ¾-ton bites with front-end loader.



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and industries which have their own plants. Future population estimates predict over 200,000 persons for 1975 and 330,000 persons for the year 2000. The County Board of Supervisors retained the author's firm to execute a study of the present and future sewerage requirements and to set forth a definite plan of action. A single plant for the entire county is not feasible because of the topography. The study indicates, however, that except for a portion of the Pascack Creek Valley, three plants with a well-designed interceptor system could adequately serve most of Rockland County. Initially, the county will give priority attention to areas in greatest need of sewer service.

"A County-Wide Approach to the Sewage Problem." By Charles T. Walsh. *The American City*, January, 1958.

A Dust-Free Incinerator

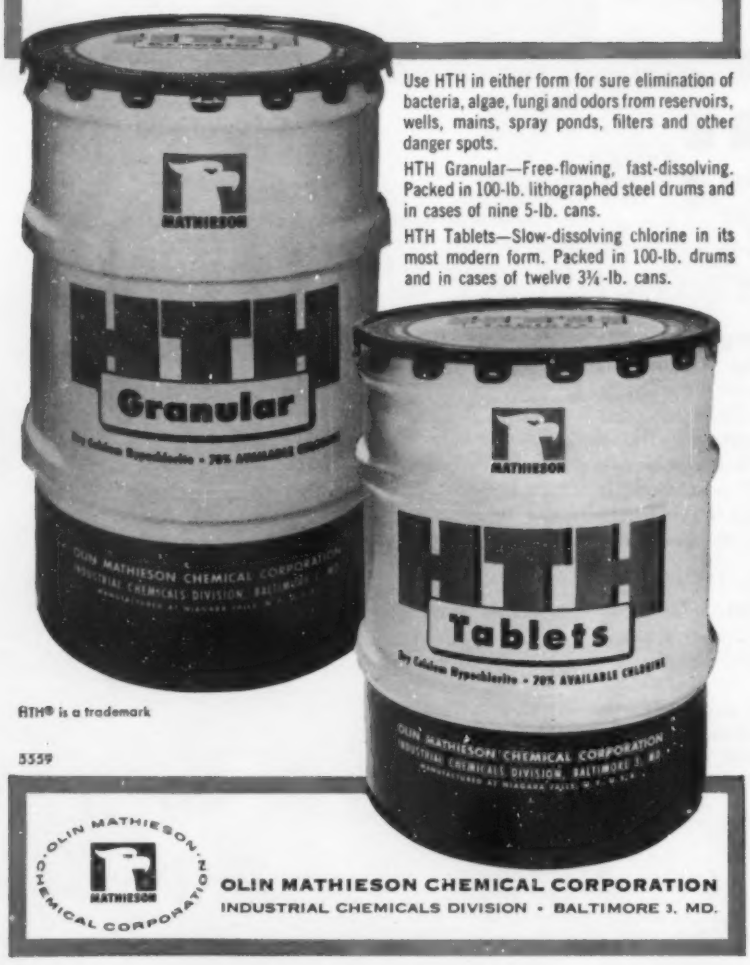
The new incinerator in Oyster Bay, N. Y., has incorporated several new ideas and devices to guarantee the absence of complaints which usually result from odors, flyash and dust. The 21-acre wooded acreage upon which the plant was built has been landscaped to give the site a park-like appearance. The crane and bin design was selected to provide flexibility in operation. The 500-ton storage pit measures 90 feet in length, 20 feet in width, and 27 feet in depth. Inlet ports along the top of the pit were provided to carry away the dust resulting from the discharge of the truck contents into the pit. Two 9,600 cfm fans discharge the dust-laden air through a filter to the atmosphere. Two additional fans have been provided to withdraw constantly the toxic and explosive gases which may accumulate at the bottom of the pit. In addition, 43 other fans have been provided throughout the plant to insure a supply of fresh air, heat and ventilation. The gases leaving the four rectangular furnaces at a temperature ranging from 1400°F. to 2000°F. assures the combustion of odor-forming particles. This heat of combustion of the refuse is converted to steam in two boilers, each with a capacity of 13,000 pounds of 250 psi steam per hour, thereby providing more than sufficient power to operate a 400-kw. steam turbine electric generator, exhaust steam to heat the building and help remove the fly ash, as well as the power to operate a 60-hp Deming deep-well pump of 500-gpm capacity. The gases also pass from the furnaces to two 2000-cu.ft. capacity expansion chambers provided with trough-like bottoms filled with water. A deflecting damper forces the gases against the water thereby trapping most of the fly ash. Tests made of the stack gases showed that slightly less than 0.30 lb. of solids were discharged per 1,000 pounds of gases, or roughly one-third the amount permitted in the specifications established in many air pollution abatement codes.

"A Dust-Free Incinerator." *The American City*, January, 1958.

Plant Completed After 10 Years

The City of North Tonawanda, N. Y., in May, 1956 finally completed the construction of its sewage treatment plant which was started under the WPA program in the early 1940's but was abandoned shortly thereafter. The treatment plant is located on a site adjacent to the Niagara River, about 3 miles north of the business area, and eliminates the last major source of municipal pollution on the United States side of the river. The population of North Tonawanda in 1952 was 25,000, with a population of 35,000 persons predicted by 1970. The Water

Your first line of protection



Use HTH in either form for sure elimination of bacteria, algae, fungi and odors from reservoirs, wells, mains, spray ponds, filters and other danger spots.

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Pollution Control Board required that the sewage be given only primary treatment followed by chlorination of the effluent. The treatment processes include screening, grit removal, primary settling, pre- and post-chlorination, sludge digestion, elutriation, and sludge drying on vacuum filters. The plant layout and design provides for future expansion to double the present capacity to 12 mgd maximum flow.

"Construction of Plant Completed After Abandonment for 10 Years." By Wilson Harleben and Newell L. Nussbaumer. *Wastes Engineering*, January, 1958.

Low-Cost Trickling Filter Cover

The City of Sarasota, Florida, has covered the trickling filter at its sewage treatment plant with a dome-shaped aluminum frame to control odors causing occasional complaints from nearby residential areas. The aluminum space frame, with a skin made of hexagonal aluminum panels, serves as the dome. A water-proofed lining hangs below the pipe frame serving to trap the odors and gases. The fumes are drawn back through the filter and released through a 100-ft. stack. The cover over the trickling filter is 112 ft. in diameter with a 27-ft. rise enclosing a filter area of 10,000 ft. An adjacent tank was also covered by a space frame. This is a pyramid-shaped structure 24 x 24 x 12 ft. high. The total cost was $39,500, or about $3.08 per sq. ft.

"Low-Cost Dome Traps Sewage Odors." *Engineering News-Record*, January 23, 1958.

Making Columbus Garbage Free

Recently Columbus, Ohio, has taken a big step toward the day when it will be free of garbage, garbage cans, garbage collection, odors, rodents and fly-breeding places. This city has recently taken two important steps toward this end: 1) by passing legislation making mandatory the installation of garbage grinders in all new residences, restaurants and eating places having kitchens; 2) by installing a 10-ton per hour pilot plant for grinding garbage at the present central incinerator. Added incinerator capacity was created by grinding the excessively wet garbage. A 5-ton storage hopper has a 36-inch live bottom, steel apron conveyor which feeds the material past a picker who removes tin cans, bottles, scrap iron and other inorganic solids. The 10-ton per hour

non-slipping power transmission licks tough coral digging

You dig coral rock when you dig in Dade County, Florida. Clevelands have been chewing out trench in these tough rock formations for over 30 years, delivering good steady production on every job. This dependable performance in rugged digging is largely due to Cleveland's time-proved system of economical power transmission to digging-wheel and crawler, through positive, power-saving, non-slipping gear trains. Cleveland's exclusive multi-speed transmission gives the operator finger-tip control of more than 30 usable, closely graduated combinations of digging-wheel and crawler speeds, putting at his command always the *right* combination of digging power and speed for every soil and terrain, for every digging condition.

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grinder discharges the slurry into the sewer. When the grinder was first placed in operation in June, 1956, some stoppage of an old sewer caused frequent shutdowns. A new 10-inch sewer line and an additional water service line were laid and since these installations were completed the grinding plant has operated very satisfactorily. It is believed that the experiences of Columbus, Detroit, Lansing and numerous other cities, plus public acceptance, will encourage other communities to use this method of garbage disposal.

"Making Columbus Garbage Free." By Harry R. Patterson. PUBLIC WORKS, February, 1958.

Other Articles

"Movement of **Coliform Bacteria** Through Porous Media." By R. B. Krone, G. T. Orlob, and Carl Hodgkinson. Sewage and Industrial Wastes, January, 1958.

"Continuous Sampling of **Trickling Filter** Populations." I. Procedures. By Wm. Bridge Cooke. Sewage and Industrial Wastes, January, 1958.

"**Two-In-One Plant** Meets Rigid Sewerage Requirements." By William F. Pillsbury. The American City, January, 1958.

"Two Long **Ocean Outfalls** Constructed." By David L. Narver and E. H. Graham. Civil Engineering, January, 1958.

"Sewage Works Practices: **Sewage Filters.**" The ninth in a series of articles. By Theodore Jaffe. Water and Sewage Works, January, 1958.

"Redox Potentials in **Sludge Digestion.**" By W. N. Grune and T. H. Lotze. Water and Sewage Works, January, 1958.

"Licking the Wear and Tear on Raw **Sewage Pumping** Equipment." By R. A. Kronewitter. Wastes Engineering, January, 1958.

"The How and Why of Operating Separate **Sludge Digestion** Tanks." By LeRoy Van Kleeck. Wastes Engineering, January, 1958.

"**Sewerage** For the 'Venice of America'." By C. E. Wright. Public Works, February, 1958.

"Effect of Earth Cover on **Fly Emergence From Sanitary Landfills.**" By Ralph J. Black and Allan M. Barnes. Public Works, February, 1958.

"The **Accelo Filter System** of Sewage and Waste Treatment." By H. W. Gillard. Public Works, February, 1958.

"**Small Sewage Treatment Plants**—Sedimentation." By John J. Baffa. Public Works, February, 1958.

Village Plan Wins Award

The Village of North Palm Beach in Florida, whose water and sewer systems were described in the January issue of PUBLIC WORKS, has been judged one of the outstanding community developments in the United States by the National Association of Home Builders. Its planning, design and presentation won first place among seven awards given at the National Housing Center in Washington, D.C., during the 1958 National Association of Home Builders merit award contest. The water and sewer systems were designed by Brockway, Weber & Brockway of West Palm Beach, Fla.

• • •

AWWA Nominations

Lewis S. Finch, vice-president and chief engineer of the Indianapolis, Ind., Water Co., has been nominated for president of the American Water Works Association; L. W. Grayson, Chief Engineer and General Manager of the Glendale, Calif., Public Service Department, has been nominated for vice-president; and William J. Orchard, well known to all sanitary engineers, for treasurer. Nomination is tantamount to election.

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3—It provides excellent drainage— The channel blocks are smooth and unobstructed and flush jointed . . .

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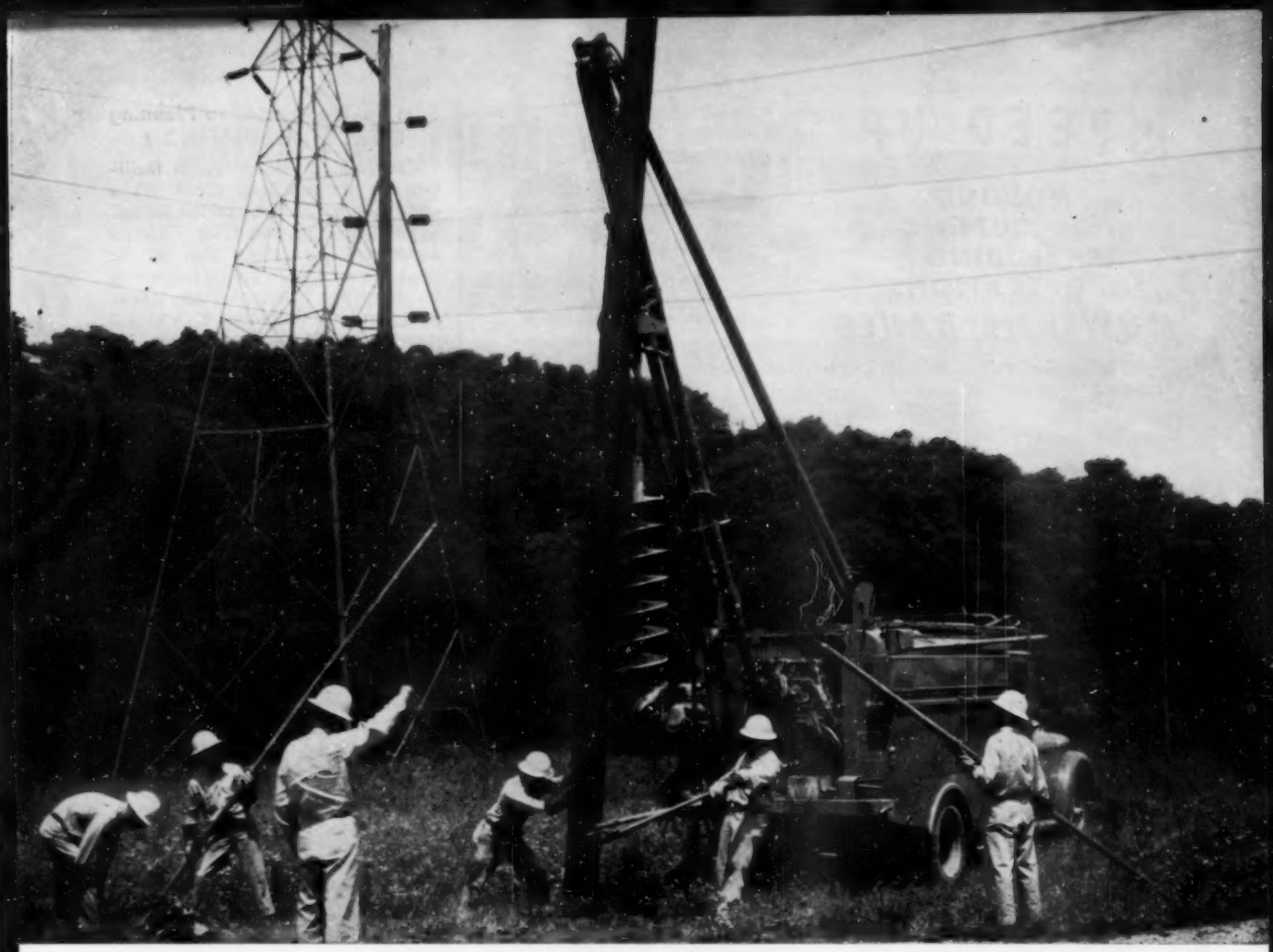

An action picture of the utility that didn't try to save a few dollars

Maybe the utility that bought this Holan body and power equipment could have saved a few dollars. But, instead of *saving*, they *invested*—and they receive their dividends in speed and long usage. See how their investment works for them!

EVERYTHING IS HYDRAULIC

Push a hydraulic control lever and the jacks come down to stabilize the truck. Push another lever and the derrick swings over. Push a third lever and the digger burrows into the ground without a shimmy, pulls out easily and shakes off the dirt. Then without a hint of strain, the 3-legged derrick sets the huge pole.

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Everything Holan makes it makes the right way. There's no skimping. No cheating to save a buck. The steel is high-tensile. The engineering is sound. The work is expert. That's why Holan equipment *sometimes* costs more, but *always* does the job best. When you specify, are you trying to save or are you investing?

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Series 4095 Hydraulic Jacks, self-stowing, move to full extension in 8 seconds, return to stowed position in 6 seconds. 14,000-pound extension.

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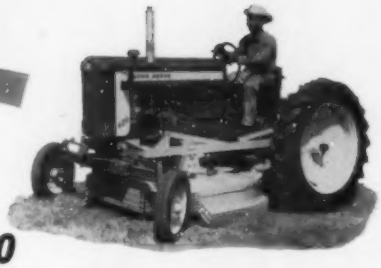

With a Danco Rotary Mower you can mow up to 60 acres per day or clear up to 40 miles of highway right-of-way per day. Here's the perfect all-purpose mower. It mows, cuts and shreds grass, weeds and brush. Mid-mount position assures low center of gravity for mowing on steep slopes, shoulders, etc. plus *maximum protection for operator.*

Danco Rotary Mowers are built rugged, to last longer, perform better — engineered and built to meet highway department specifications. Heavy-duty construction assures low cost operation. Hardened spring steel blades and the exclusive Danco non-wrap spindle assures peak performance. Danco Rotary Mowers are now giving excellent performance throughout the nation.

Danco mowers are available in 60", 66" and 96" cuts for use with: Allis-Chalmers, J. I. Case, John Deere, I.H.C., Minneapolis-Moline and Oliver tractors. Write for free descriptive literature, specifying tractor model.

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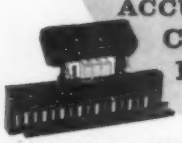

Lightweight, portable Taylor Comparators let you make fast, accurate colorimetric tests for pH and chlorine in minutes . . . not hours! Quickly give you dependable operational data to help you control water or sewage operations. On-the-spot tests are made by placing treated sample in the middle tube and moving the color standard slide across until sample matches one of the standards. Values are read directly from the slide. Complete water analysis, including fluoride, only a little more detailed with the Taylor Water Analyzer.

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Film on Transportation Planning Offers Traffic Jam Relief

Coordinated transportation facilities for metropolitan areas get a close look in "Millions on the Move," a new film prepared by General Electric. Pointing out that in the next 20 years, more public funds will be spent for metropolitan transportation than any other area except defense, this full-color picture reviews the advantages of suburb-to-city rail transit in an over-all city transportation plan. One lane of rail rapid transit, it notes, can move as many seated passengers as 20 automobile lanes, with no downtown parking problem.

Commuter traffic poses a special problem in the metropolitan transportation system by jamming highways in rush hours and filling parking areas. Among the facilities to be evaluated for a coordinated solution are separate rights-of-way for rail transit, perhaps in the center mall of new expressways; outlying parking areas to allow wider use of transit facilities; feeder buses and full utilization of existing commuter railroads.

Prints of the new movie are available from local General Electric Apparatus Sales offices.

Michigan Highway Program

State Highway Commissioner John C. Mackie of Michigan has announced a schedule for letting some 600 highway construction contracts through July 1, 1962, as planned in his five-year, $1,250 million dollar highway program.

The schedule covered contracts which will give Michigan 900 miles of new expressways connecting major Michigan cities of 50,000 population or more; provide for new construction or reconstruction of a total of 2,900 miles of highway; and pave all the remaining 800 miles of gravel roads on Michigan State trunkline highways.

The schedule is entirely contingent upon the following factors: 1) It plans on using all forecast state and federal revenues to the maximum and if revenues are increased, the program can be accelerated, and if they are reduced, the program will be delayed. 2) The schedule is contingent on reaching agreement with local municipalities affected on route location and cost sharing agreements. 3) The schedule allows time for right-of-way acquisition by negotiations or by condemnation, but could be delayed if legal proceedings delay entry by the contractor.

multiply tractor use ...on any job ...in any season

Whether it's June or January, M-B sweepers help you get more value from your tractors. No matter what the season, there's always a job best handled by a tractor sweeper. Here are only a few examples from dozens of typical applications: sweeping sidewalks, streets and playgrounds of dirt and debris; clearing snow up to 6″ in depth from thoroughfares, parking lots, etc. . . . also a handy clean-up unit for following snow plows; sweeping grass in parks and on boulevards; keeping runways, parking lots and driveways clear at airports; sweeping street and highway surfaces clean before and after black-topping . . . there's no limit to the

variety of jobs. ▪ With new, M-B two-way hydraulic sweepers, you finish sweeping jobs even faster and more efficiently than before. Your operator has complete control of the two-way, 30° sweeper angle, brush lift and brush rotation while working. "Dead runs" are reduced and the operator has unmatched maneuverability in the tight spots. ▪ M-B hydraulic sweepers are easily mounted on most popular make tractors and tractor-loaders . . . the sweeper head can be separately mounted or removed in minutes. Brooms are available in 32″ diameter, 60″ and 72″ lengths . . . may be turned end-for-end to maintain even wear. M-B mechanical drive tractor mounted sweepers and heavy duty, pull type sweepers have the same high standards of construction and performance. ▪ Your tractor dealer has complete information on the M-B sweeper best suited to your requirements. Call him now for the full story.

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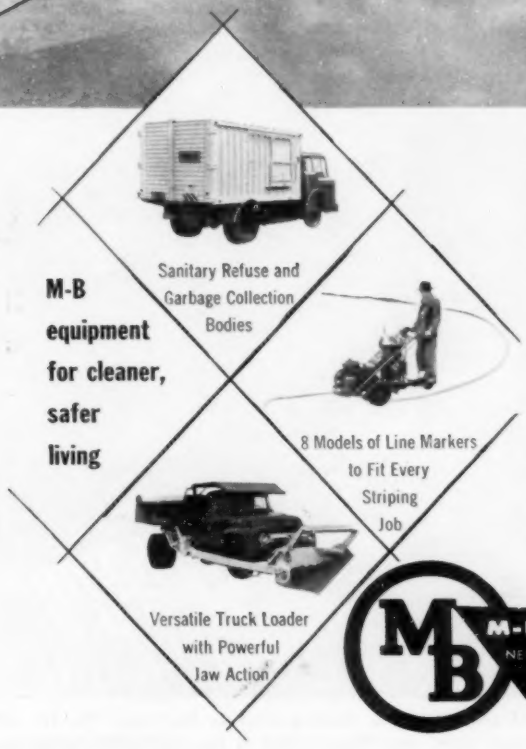
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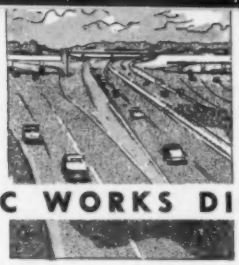


PUBLIC WORKS DIGESTS

Prepared by

FRANK FORCE

Associate Editor

THE HIGHWAY AND AIRPORT DIGEST

Seal Treatments On Bituminous Concrete Pavements

The success of a seal treatment is largely dependent upon the protection provided during the curing period. Detours should be used for 24 hours whenever possible in seal treatment maintenance. Seal treatments are applied in Virginia both by State forces and by private contractors. In the application on bituminous concrete pavements, the bitumen may be cutback asphalt, Grade RC-2 or RC-3; or emulsified asphalt Grade AE-2 or AEM-2; with RC-2 and AE-2 or AEM-2 being predominantly in use. The cover aggregate may be either sand or crushed gravel, stone or slag. A typical rate of application on a sand asphalt pavement utilizing No. 12 slag aggregate for cover would be 0.20 gal. of RC-2 or 0.25 gal. of AE-2. The average rate of applying aggregate is 20 to 25 lbs. psy for crushed gravel and stone, and 16 to 20 lbs. psy for slag. The aggregate is applied with a roll-type box spreader attached to a truck and rolling is done by tandem or 3-wheel rollers weighing from 7 to 10 tons or by rubber tired rollers.

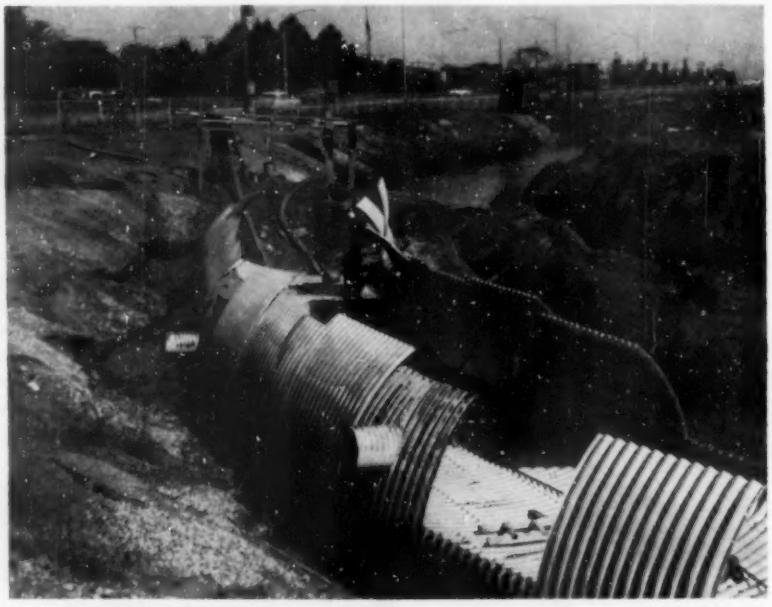
"Seal Treatments On Bituminous Concrete Pavements." By W. S. G. Britton, Assistant Maintenance Engr., Virginia Dept. of Highways. PUBLIC WORKS, February, 1958.

Twin Highway Tunnels Are Driven From One End Only

To tie a major traffic interchange to Pittsburgh's downtown Golden Triangle, twin bores will go under residential Mt. Washington to become the Fort Pitt Tunnel. The twin tubes start at the same level at the south portal, but the easterly of the two (which will carry northbound traffic) will be 18 ft. higher than its twin at the north portal. The tubes will be 3435 ft. long. They will be 32 ft. 10 ins. excavated width at the line of the floor slab, with a finished width at this point of 29 ft. 4 ins. Each will carry two 12 ft. roadways, with a 2 ft. 9 in. sidewalk and a 1 ft. 6 in. wide curb at one side, a 1 ft. 7 in. curb at the other. Clear height to the hung ceiling will be 14 ft., with the space above the ceiling being used as an air duct. The roadway base will be a 1-ft. layer of stone and a layer of waterproofing paper overlaid with a 10-in. reinforced concrete slab. Wearing surface will be of brick. Underlying the base stone, in a trench cut in the center of the roadway, will be an 18-in. clay pipe drainage line, fed by 6-in. clay pipe laterals at 50-ft. centers. There will be 224,000 cu. yd. of rock to be removed from the tunnels. A jumbo is cutting an average of 110 holes per round, in a circular pattern designed to cut out the full width of the horseshoe-shaped tubes. The holes are drilled to depths of 10 ft. and loaded with 3 lbs. of gelatin blasting agent per cu. yd. of rock. Average shot, with standard delay caps, produces about 248 cu. yd. of

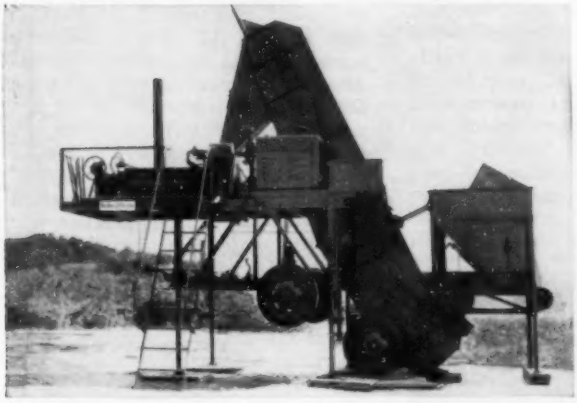
Airport Improvement Requires Better Drainage

FOR eleven years, Philadelphia has been improving its airport by providing better drainage. The latest, following extensive subdrainage and storm flow lines, consisted of 713 ft. of 5-gage 184-in. span by 111-in. rise Armco multi-plate pipe arch, including four 13-degree elbows to permit curve construction and 15, 18 and 36-in. stubs welded into the line for connections. John W. Meehan & Sons was contractor on 590 ft. of pipe and Herbert J. Elkins on 123 ft. Poor foundation conditions required a prepared foundation of crushed stone and sand and bypassing of a stream. Both contractors erected the bottom three plates off the immediate site, later placing them in the trench where the balance of the assembly was made.



● **TO FACILITATE field connections to existing lines in the area, 15, 18 and 36-in. corrugated metal pipe stubs were shop welded to the Multi-Plate structure.**

Start with an asphalt plant that can grow with your business



Begin with a mixer, elevator and hopper, and you're set to produce stabilized and cold bituminous mixes at capacities of more than 50 t.p.h. For a low initial investment, the Barber-Greene 840-B gives you big plant features and flexibility.

Later add a dryer to produce hot mixes (to 45 t.p.h.) suitable for nearly every type of paving job. With an aggregate feeder to control cold feed gradation, the complete range of hot mixes can be produced—except specs requiring screening after drying.

For high type mixes, expand operations with a gradation unit to produce mixes (to 45 t.p.h.) to meet any specification. A complete line of dust collectors, cold feeders, mineral feeders is available to meet all of your requirements.

Get big plant features with the low cost Model 840-B. A new, longer twin shaft pugmill, hydraulically operated pugmill discharge hopper, interlocked proportioning, speedy setup, unexcelled portability—all provide more production and profit. 56-5A

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stone. The work is being done from only one end of the tunnel, because of the rough terrain.

"Twin Highway Tunnels Are Driven From One End Only." *Engineering News-Record*, January 16, 1958.

All Trunk Roads Passable All The Time

The Minnesota Highway Department has 1500 trained men available for its winter-maintenance tasks on its 11,800 miles of trunk highways. A large fleet of mechanized equipment that includes rotary snow units, interchangeable plows for mounting on trucks and motor graders, wing blades, 2½ and 3-ton trucks, 4 to 10-ton trucks, motor graders, rotary ice crushers, sand spreaders and hopper-body sand spreaders is used for snow removal. There are 475 contractor-owned motor graders that are made available during the winter on an hourly rental basis with the successful bidders supplying the machine, operator, fuel, other supplies and maintenance. A mechanical ice crusher that can be mounted under a motor grader or heavy truck and operates at 7 to 9 mph has been devised. The heart of the machine is a bilateral spiral blade mounted on a rotating shaft so that it cuts the ice in a V-pattern as it moves along the pavement. Sand mixed with calcium chloride or salt is stockpiled at convenient points in each district. 700 miles of slat-type snow fence is set at required locations to prevent the snow from drifting. The highway department roadside-development section has planted more than 600 miles of evergreens to create a "natural" snow fence. The road-information service operates throughout the year and its winter-time rapid transmission of weather and road information helps the maintenance forces to speed snow and ice-removal operations and to advise the public when and where travel is advisable.

"Goal: All Trunk Roads Passable All the Time." By George Meskal, Maintenance Engineer, Minnesota Dept. of Highways. *Better Roads*, January, 1958.

Litterbags—An Answer To Our Cluttered Highways

The Texas Highway Dept. gave 50,000 green and brown bags last summer to 7 Highway Travel Information Bureaus for distribution to motorists stopping at the bureaus for information. After the test period 200 maintenance foremen throughout the state were polled for comments on the value of the litterbag program. About 70 percent commended the idea, 20 percent opposed the plan and 10 percent did not comment. Most of those in favor of a wide-scale distribution of litterbags felt that all motorists would have to have an opportunity to receive the sacks, and that proper disposal units must be provided for the bags. Several comments made on the questionnaires bear out the fact that if motorists are properly educated against throwing litter and are provided litterbags, they will use them. Beer cans and liquor bottles seem to be one of the biggest problems.

"Litterbags—An Answer to Our Cluttered Highways?" *Texas Highways*, December, 1957.

Aerial Survey In Major Road Improvement Schemes

In addition to schemes for new and improved roads, modern aerial survey methods can and are now being used for all forms of site investigations and true to scale surveys prior to the preparation of railway improvement schemes, land reclamation, reservoirs, archaeologi-

low initial cost
low erection cost
lowest maintenance cost

Here's a new all-aluminum sign developed especially for the large signs required on major expressways. The "Increment Sheet Sign" consists of aluminum increment sheets hung vertically on a supporting frame. It can be made in any height or width, and for ground or overhead installation. Each sheet engages with the adjacent sheet, providing a smooth-faced sign panel.

The advantages are obvious; new lows in the cost of material, installation and maintenance. The aluminum never needs painting or other costly maintenance. Erection is quick and easy. Reflective materials or painted backgrounds are available in any type letters or symbols. As for strength, the sign above, on New Jersey's Garden State Parkway, is designed to withstand wind in excess of 100 m.p.h.

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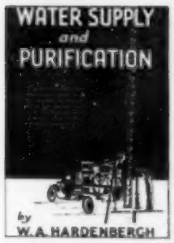

Water Supply and Purification

By W. A. Hardenbergh

Among the major changes introduced in this latest edition are the following: The chapters on ground water, on filtration, and on laying pipe and maintaining lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up-to-date; and a new chapter has been added on fluoridation. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-1 on the coupon.

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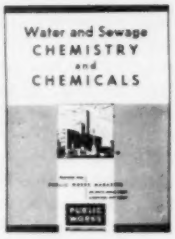

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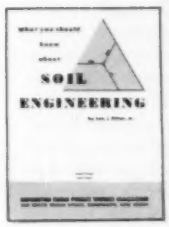

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This major article was prepared in close collaboration with U.S. Public Health service authorities. It includes, for the first time in magazine history, full and accurate color plates for the identification of types of algae most important in water supplies—those which cause taste and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. To order your copy circle A-5 on the coupon.

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This valuable text has been completely revised, expanded and brought up to date. In it all phases of Sewage Treatment Plant operation are treated in simple, easily understandable language. Among the many subjects covered are: measurement flow; concentration and temperature; sampling sewage for analysis; laboratory determinations; purposes of treatment; operation of grit chambers; operation of screens; trickling filter operation; filter fly control; disposal of sludge; etc. To order your copy circle A-7 on the coupon.

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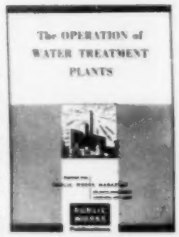

Here in one place you have the basic information concerning all phases of plant operation. Even those without previous technical school education will find it easy to learn from this valuable text. Completely revised, expanded and brought up to date by Clayton H. Billings, Associate Editor of Public Works. This reprint is of special interest to Water Works Superintendents, Water Treatment Plant Operators and everyone connected with the Water Works field. To order your copy circle A-8 on the coupon.

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cal excavations, location of mineral resources and planning redevelopment proposals. When considering the possibility of employing aerial survey methods a road engineer will naturally require, in the first instance, to compare the probable cost of such surveys in relation to the cost of ground methods and including the necessary levelling and plotting required for the finished survey plan. For open undulating areas at 1/500 scale the cost may vary from £ 350 to £ 550 per mile length of survey for variable widths of 200 to 450 ft.; in built-up areas where widths of 150 to 300 ft. may be adequate the cost will be in the same order. Generally the advantages may be summarized as a detailed actuality record produced in the shortest possible time without reliance on the fallibility of the human element. Aerial surveys should be made between September and May in order to avoid misrepresentation of levels and contours by standing crops and where ground detail is obliterated by over-hanging foliage. Increasing air traffic is causing a hindrance in the vicinity of airfields and established flight lanes. The procedure and technique of aerial survey is reasonably easy to understand by the road engineer.

"Aerial Survey in Major Road Improvement Schemes." By Col. T. U. Wilson, County Surveyor, Lanarkshire. *The Surveyor*, January 11, 1958.

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Citizen Cooperation Doubles Paving Budget

In Twin Falls, Idaho, two methods of financing street improvement and resurfacing work are used. In the one method, the property owners pay the city for the cost of materials used and the city furnishes all supervision, labor and equipment. Material costs come to approximately 25¢ psy for a 4-in. compacted thickness of base gravel, and 50¢ psy for 2 inches of asphalt pavement plus a seal coat of asphalt and chips. The second method consists of setting up a local improvement district. In this case, a bonding company usually puts up the money. Assessment rates are payable in 10 equal annual payments plus interest on the unpaid balance. In this method of financing curb, gutter and sidewalk are included. This work is let out to private contractors on a bid basis, with the city doing the paving work. Assessments include the curb, gutter, sidewalk and the cost of the material used by the city and the cost of setting up the paving district.

"Citizens Cooperation Doubles Paving Budget." By H. H. Ballenger, Supt. of Streets & Water, Twin Falls, Idaho. *American City*, Jan., 1958.

Evaluation of Urban Intersection Design

Intersection design is a facet of highway or street design toward which the planning, location, design and traffic engineers are directing more and more of their attention in resolving their various engineering problems. Urban traffic congestion can be relieved effectively by the construction of new arterial highways and the improvement of existing ones, particularly within the intersection areas. Adequate and sufficient intersection design can be developed by obtaining all physical data for the site and determining those influencing the facility; collecting and analyzing the traffic data to determine the traffic flow pattern and the necessary reometric control dimensions and facilities; collecting and analyzing all factual data; determining the location and type of facility; preparing alternate develop-

ments for study of suitability in meeting traffic needs and design controls; calculating cost estimates for each alternate lan and road user costs and index of road user benefits for each alternate plan; and preparing detailed design.

"Evaluation of Urban Intersection Design." By R. J. Furbeck, Illinois Dept. of Public Works and Buildings, Division of Highways. PUBLIC WORKS, February, 1958.

A City In the Parking Lot Business

Greensboro, N. C., has 8 municipal parking lots with a total of 822 spaces in the busy downtown section. When the city parking lot policy was set up, with the installation of the first meters, it was determined that all revenue from the meters would go into a fund for the relief of traffic congestion. Citizen-owned lots have never had to fear the competition of the city. The lots are smoothly paved and kept clean. The entrances and exits are wide enough to permit easy maneuvering. Car spaces are unusually wide and long and the parting lines are double, to make plenty of room for opening car doors. Six of the lots are operated by attendants and in two lots "ticket spitters" and gates are installed. These electronic devices automatically stamp tickets and lower gates enabling cars to enter and leave the lots. At the present time income for the fund, from parking lots and meters, is about $115,000 a year. The lots have cost an average of $800 per car space, varying from $1100 down to $500. This includes all work: clearing, leveling, paving, electronic gates and meters. The revenues average about $70 per space per year, ranging from $110 down to $50.

"Can a City Stay Out of the Parking Lot Business." By Guy Browning Arthur. PUBLIC WORKS, February, 1958.

Concrete Pavement Reinforced With Welded Wire Fabric

Reinforcing steel is now specified for portland cement concrete in over 70 percent of the yardage of concrete pavements being constructed by the various state highway departments. For concrete pavements on Turnpikes, in operation or under construction this figure is better than 95 percent. About 90 percent of the reinforcing steel is welded wire fabric. Reinforced concrete pavements are divided into slabs from 40 to 100 ft. in length. Load

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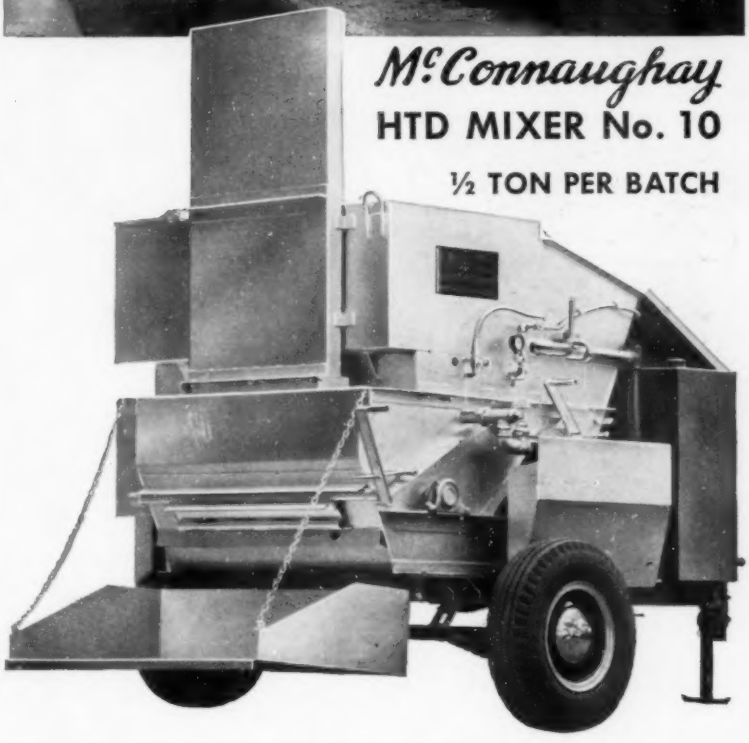

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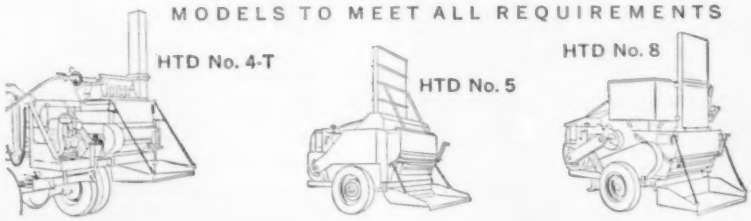

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transfer devices must be provided at slab ends so that the two adjoining slabs will act together under applied wheel loads rather than acting independently with consequent excessive deflections. Proper handling and placing of welded wire fabric will simplify paving operations and insure maximum production. In wire fabric, the longitudinal wires are generally spaced 6 inches apart while transverse wires are 12 inches center to center. Sizes of wires will vary with the length and thickness of the slab and the allowable stress in the steel permitted by the designing engineer. In single lane paving a keyed joint is formed by attaching a metal or wooden strip to the inside of the sideform to produce a keyway. While preparing the subgrade on the second lane, it is now customary to use hook bolts consisting of two pieces of 9/16-in. or 5/8-in. steel, each threaded at one end and fastened together by a coupling. In full width paving the longitudinal joint may be either formed or sawed in which case tie bars are used to tie the two slabs together. The tie bars may be installed on the grade with metal supports before the concrete is deposited or may be inserted in the first layer of concrete poured before the fabric is placed. The most commonly used device for transfer of load between slabs at transverse joints is the round steel dowel bar supported in a steel framework resting on the subgrade or subbase. Several states are experimenting with stainless steel encased dowels.

"Portland Cement Concrete Pavement Reinforced with Welded Wire Fabric." By Henry Aaron, Chief Engineer, Reinforced Concrete Pavement Div., Wire Reinforcement Institute, Washington, D. C. *Modern Highways*, January, 1958.

Other Articles

"Establishing Boundaries of Roads Centuries Old." Cumberland County, Maine, is re-establishing their county roads that were laid out around 1760. By Harlan H. Sweetser. Cumberland County Engineer, Portland, Maine. Public Works, February, 1958.

"Motorways and Traffic Engineering In Belgium." Brussels spends £14 million on new roads to ease city congestion. The Surveyor and Municipal and County Engineer, December 15, 1957.

"Roads From the Beginning." This survey describes road-building methods not only in Britain but abroad, and reviews the growth of road systems from early times to the present day, including the development of materials and the gradual adjustment of design to traffic loads. By E. J. R. Kennerell, BSc (Eng.), AMICE, MInst.HE. Contractors Record and Municipal Engineering, December 11, 1957.

"Some Aspects of **Pile Foundations.**" Piles driven or placed into the ground vertically, or nearly so, and which support vertical loads. By I. F. Morrison and S. R. Sinclair, Respectively Professor-Emeritus and Associate Professor of Civil Engineering, University of Alberta. Roads and Engineering Construction, December, 1957.

"Signal System Designed For Downtown Traffic." New signal system must handle the heavy traffic of today, must be capable of handling future traffic to the limits of the physical capacity of the street system and must provide protection for pedestrians. By R. T. Gregory, Director of Planning and Traffic, Waco, Tex. Public Works, February, 1958.

"Soil As a Construction Material—Part I." By Leo J. Ritter, Jr. Modern Highways, January, 1958.

"Soil-Cement Sidewalks Constructed Departmentally By the Germiston City Engineer's Department." By L. H. West. South African Municipal Magazine. November, 1957.

"In One Season, Maryland Places Million Tons of **Calcium Chloride Stabilized Base Mix.**" Roads and Streets, January, 1958.

• • •

Prestressed Concrete Bridges

(*Continued from page* 97)

A bridge with pile foundations will be more costly than one with spread footings. The type of abutments required will have a large effect on the square foot cost of a short bridge. The following data were taken at random and no attempt made to select bridges that were of equal spans, similar locations, etc. to the prestressed bridges: The flat slab cost $5 to $15 psf of bridge; the T beams were $6.28 to $12.65 for crossings and $6.84 to $15.14 for waterways; and box girders were $12 to $14 for 100-ft. spans; $7 to $16 for short spans.

Use Of Prestressed Design

At locations where falsework would be costly, such as the low mud flats at the Eureka Slough and Richardson Bay Bridges, a precast prestressed girder design has several advantages over a conventional concrete structure including elimination of falsework, of form construction and concrete placement in site, and faster construction.

On city streets and highways with heavy traffic a precast prestressed design eliminates the need for falsework which often is a serious traffic hazard. On railroad separation structures the elimination of falsework and fast erection of precast units are important advantages.

Proper spring maintenance, supported by summer sweetening applications of Columbia Calcium Chloride, keeps roads firm, prevents dusting or raveling.

Now's the time to check aggregate, reshape roads, and get ready to spread Columbia Calcium Chloride

Good spring and summer roads are made right now! Smooth, compact, durable surfaces don't just *happen* . . . they're the happy result of your early maintenance, carried out this tested three-step way:

1. CHECK for proper balance of aggregate and binder in the roadbed, adding where necessary. 2. RESHAPE to proper crown while sufficient moisture is still in the ground. 3. TREAT with Columbia Calcium Chloride.

Columbia Calcium Chloride aids so greatly in consolidating existing and added materials that only three or four bladings per year are usually necessary. Annual gravel loss is cut up to 75%, too. And what a help you'll find it in stabilizing shoulders. Lower maintenance costs, yet safer and more comfortable driving . . . no wonder Columbia Calcium Chloride is the preferred road treating chemical. You'll use it throughout the summer for effective dust control, as well.

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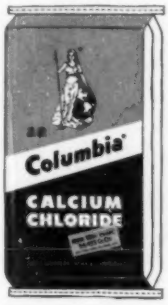
New High Test Flake (94-97% $CaCl_2$) is now available as a companion product to Regular Flake (77-80% $CaCl_2$). Each 80-lb. bag of High Test does the job of a 100-lb. bag of Regular.



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The shallower depth of prestressed design can effect economy by the lesser height of the bridge deck above stream bed or a city street or highway. A foot less fill height can effect considerable economy in roadway embankment and in street connections in an urban location.

The Hoppow Creek Bridge illustrates the advantage of a shallow girder depth where maximum waterway is needed on a low highway approach. The Bacon Street Overcrossing is a good example of the use of prestressed design in keeping height of roadway embankment to a minimum.

The shallow slab depth of the Harkness Street Pedestrian Overcrossing gives the structure an appearance hard to obtain with a heavier slab or girder design.

On the double deck viaducts in San Francisco and Oakland, prestressing was used to obtain shallow cap depths for vertical clearance.

A novel and interesting use of prestressing was employed in the construction of a ramp under the existing San Francisco-Oakland Bay Bridge where one column in each of two bents of the existing bridge was directly on the line of the new ramp and had to be removed.

Pretensioned concrete piles have been used on several bridges. Piles up to 105-ft. in length were used on the Eureka Slough Bridge. With a two-point pickup, the longest pile could be handled with no observable deflection.

Summarizing, we have found prestressed concrete advantageous in the solution of many design problems and as we gain more experience we expect to utilize prestressing to a more varied and greater extent on our structures.

• • •

Electronic Devices

(*Continued from page* 117)

Hydraulics and Hydrology. Water management of a multipurpose reservoir system; flood routing; backwater profiles; hydraulic network analysis; water hammer analysis; surge-tank analysis; turbine speed regulation; analysis of wave motions; flow of ground water; flood flow forecasting; flood frequency analysis; wind-wave analysis; unit hydrographs; and compressible and incompressible flow.

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traverse work, picture points, hydrography and mine surveys. The unit is small, compact, portable and easily erected and may be used for many survey purposes, including geodetic control.

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microwaves of 10 cm wave length eliminates dispersion effects so that visibility is of no concern. It can be operated from a simple scaffolding or tower of minimum stability. The Tellurometer is said to measure distances within an accuracy of about 3 ppm ± 2 inches on lines up to 35 miles.

The minimum effective range is approximately 500 feet. The maximum range varies from 30 to 40, or even 50 miles, depending on line of sight conditions.

Both the set and carrying case are provided with carrying handles; a back-packing harness is furnished to be used with either. Total weight is approximately 57 pounds for each unit (less battery).

• • •

Aluminum Highway Bridge

The first aluminum girder type highway bridge in the world will be constructed near Des Moines, Iowa, to carry traffic across a four-lane inter-state express highway. The developmental project is being jointly sponsored by the Iowa State Highway Commission and by the Aluminum Company of America, Kaiser Aluminum & Chemical Corporation, and Reynolds Metals Company.

A general contract for $124,682 has been awarded to Jensen Construction Company and United Contractors of Des Moines. The aluminum fabrication will be performed by Pullman-Standard Car Manufacturing Company, Chicago. Site preparation is now underway and the bridge is scheduled for completion next summer.

Designed by Ned L. Ashton, Iowa City Consulting engineer, under the direction of the Iowa Highway Research Board and the Iowa State Highway Commission, the bridge will be a four-span continuous aluminum girder structure with a composite reinforced concrete deck. It will be 222 feet long, 36 feet wide with a 30-ft. roadway, and will be supported by concrete piers.

Four continuous longitudinal girders will be used under the roadway spaced 9½ feet apart. The girder and diaphragm system will be primarily of welded plate construction, taking full advantage of high strength weldable aluminum alloys. The concrete deck will be tied rigidly to the aluminum girders with aluminum shear connectors to achieve composite action. The bridge is designed for H-20-S16 loading in accordance with AASHO specifications.

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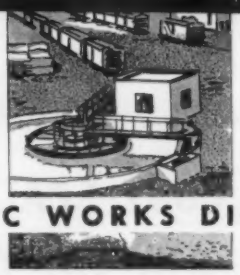


PUBLIC WORKS DIGESTS

Prepared by
CLAYTON H. BILLINGS
Associate Editor

THE INDUSTRIAL WASTE DIGEST

Radioactivity Analysis Techniques for Water Sources

When released into the environment certain radionuclides concentrate in bottom muds, soils and biological materials. Accordingly, analyses are required to determine the degree of such concentration and the amounts of activity contributed. For water, the sample is filtered through a membrane filter and the residue on the membrane is dried, weighed and treated for counting. The filtrate is evaporated to dryness; the solids are then acidified and transferred to a weighed dish and dried again. Soil samples are moistened with distilled water spread in thin films on tared dishes and oven- or air-dried. Biological samples such as leaves, grass, fish bones, and algae are prepared for counting by determining dry solids at 103°C and fixed solids at 600°C. The solids are acidified and transferred in thin films to counting dishes. The gross alpha and beta radioactivity on these samples is measured by counting in internal, gas flow, proportional counters having a maximum efficiency of about 50 percent for alpha and 65 percent for beta activity from one-year-old mixed fission products. The methods used are suitable for estimating nonvolatile radioactivity at levels far below 100 μμc per liter (the maximum permissible concentration of unknown radionucleides in drinking water), are applicable at levels exceeding 100 μμc per liter, and may through decay measurements or a knowledge of radionuclide composition, indicate the health significance of observed activity.

"Analysis of Radioactivity in Surface Waters—Practical Laboratory Methods." By L. R. Setter, G. R. Hagee, and C. P. Straub, Robert A. Taft Sanitary Engineering Center. *ASTM Bulletin*, January, 1958.

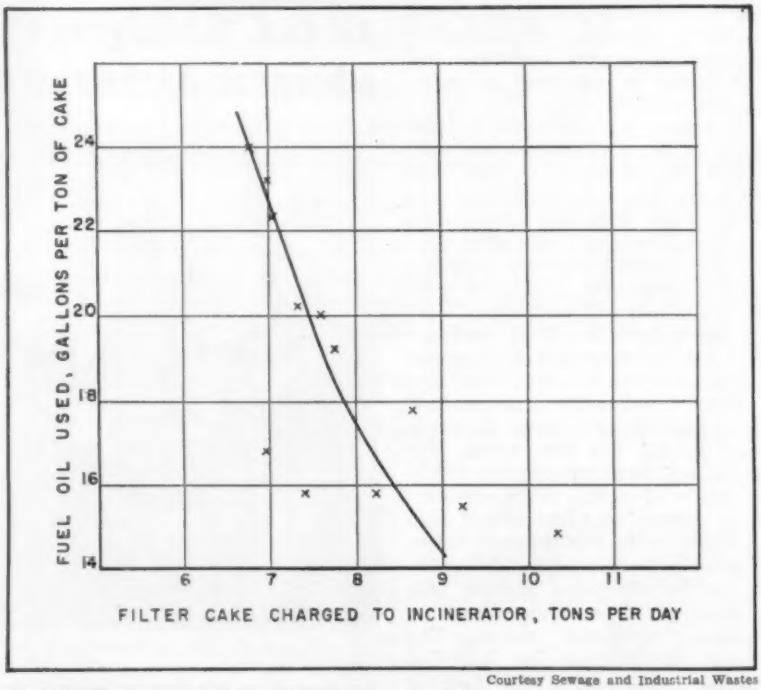
Tannery Wastes Treated with Sewage

To overcome pollution problems at Williamsport, Pa., a plant was designed to handle a maximum load of 0.5 mgd of tannery waste and domestic sewage from a population of 10,000. It incorporates a bar screen, grit chamber, preareation tank, and primary sedimentation facilities. The tannery waste is received in a holding tank from which it may mix with the domestic sewage either ahead of the preaeration tank or following the tank. Sludge is dewatered on two coil-type vacuum filters, with filter cake destroyed in a 6-hearth incinerator. During three of the first 12 months of operation, more suspended solids left the plant than entered, but BOD removals ranged from 43.6 to 57.1 percent. This is believed to be the result of chemical reactions between sewage, tannery wastes, and filtrate from the vacuum filters. One of the reactions may be the precipitation of normal carbonates resulting from mixing the caustic alkalinity of the tannery wastes with the bicarbonate alkalinity of the sewage. Experiments with conditioning sludge for filtration showed that with this type of sludge, two-stage thickening and the use of lime with ferric chloride is necessary to yield a sludge of 8 to 10 percent solids. The incinerator is charged with filter cake 11 to 14 hours per day for five consecutive days, normally. The incinerator has operated without significant odor or smoke and would operate more efficiently if the sludge cake load could be more uniform.

"Tannery Wastes Treatment with Sewage at Williamsport, Pennsylvania." By T. R. Haseltine, The Chester Engineers. *Sewage and Industrial Wastes*, January, 1958.

Atmospheric Odor Control

Methods of removing odors from gases are dispersal by stacks, combustion, adsorption, absorption and modification. Stack dispersal should be recommended only after data on odor pervasiveness have been obtained. Equipment used for odor



Courtesy Sewage and Industrial Wastes

● **CHART shows variation of fuel use with daily rate of filter cake charging.**

P.F.T.

NEW DEVELOPMENTS IN SEWAGE TREATMENT

P.F.T. prefab aluminum roofing being installed at the Mill Creek Sewage Treatment Plant, Cincinnati, Ohio. Twelve 110-ft. P.F.T. Floating Covers are equipped with this new roofing. Consulting engineers: Havens and Emerson, Cleveland, Ohio.

Now! Lifelong decks for floating covers with new P.F.T. prefab metal roofing!

P.F.T. aluminum roofing is as permanent as the floating cover itself. Unlike conventional job-built decks, there is no wood or composition to rot. P.F.T. aluminum roofing requires little or no maintenance.

This new P.F.T. roofing consists of sturdy prefabricated panel sections; heavily embossed aluminum top sheets, and corrugated supporting bottom sheets. An inch-thick layer of Fiberglas insulation fills the space between. A liner of aluminum foil gives additional protection against heat loss. Helps maintain proper digester temperature control, and keeps heating costs down.

Shipped in easily handled sections, P.F.T. aluminum roofing installs quickly. Each piece is clearly marked for fast, accurate assembly at the plant site. Cut-outs and trim for manholes, sampling wells, hatch framing and other openings are shop fabricated. Aluminum ventilators are provided at the center, and over the sump wells at the rim. A 19"-wide service walkway also is furnished, extending from rim to center dome.

Section of P.F.T. roofing showing (1) aluminum top sheet, (2) inch-thick Fiberglas insulation, (3) aluminum reinforcing channels, (4) corrugated supporting ribs.

P.F.T. prefabricated aluminum roofing is available for both new and existing floating covers. For long range economy, it is the most permanent, best insulated roofing available. For complete details, write today for newly published, illustrated, 12-page Technical Bulletin No. 333.

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Lowest in installation, operation, maintenance costs. Greatest efficiency and sanitation. No complex piping, screens, impellers, shredders, etc. Discharges sewage at rate of 30 to 500 g.p.m, heads up to 150 ft. Hundreds in use, everywhere. Backed by 60 years of experience.

WRITE FOR CATALOG S-55

Shows application, advantages, dimensions and layouts of B-S Pneumatic Sewage Ejectors, single and duplex units. Describes exclusive features of float, electric and pneumatic controls. Tells how to select proper size ejector.

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control by combustion comprises direct-fired air heaters or devices for catalytic combustion. The catalyst employed to aid combustion is embodied in a platinum alloy-activated alumina coating on porcelain rods set into a brick-like unit or a platinum alloy coating on nichrome wire arranged like a filter mat. Major deterrents to use of catalytic combustion methods have included high fuel costs and the expense of platinum-group metals. The control of atmospheric odors by adsorption has been limited almost entirely to the use of activated carbon. The upper practical range for activated carbon application is 2 to 5 ppm as compared with 1000 to 1500 ppm for catalytic combustion. Decontamination of a stream of odorous air by washing it in a liquid is called absorption. Scrubbers include packed, plate, and spray towers, agitated tanks, and water jets. It is possible to control odors on a perceptual basis, physical or chemical changes not necessarily being involved. This is referred to as "modification." Two vapors, both capable of stimulating odor perception, when mixed can result in cancellation of each other, reducing an objectionable odor below the objectionable concentration level, or in adding to the effect. The first two consist of counteraction. If the mixture results in a more pleasant odor, the process is called "masking."

"If Your Problem Is Getting Rid of Obnoxious Odors, There Are Five Basic Methods Available." By Amos Turk. *Industrial Wastes*, January-February, 1958.

Review of Dust and Mist Separators

Mist and dust collection consists of making particles move out of the main gas flow onto a collecting surface or into a concentrated boundary stream and of removal of the accumulated dust layer or mist film from the equipment. The mechanisms by which the particle is made to move out of the main gas stream are settling, direct filtration, inertial separation, and electrostatic precipitation. Particles larger than 40 microns can be removed from a gas by gravity settling in a chamber where the holdup time is large enough for the particles to fall from the top limits of gas flow onto a collecting surface. Any substantial enlargement in the flow cross section can act as a settling chamber. In the bag filter, a layer of dust already deposited by impaction and interception does the filtering. The cloth used in fabricating the bag is selected on the basis of gas temperature, with an upper limit of 600°F. In inertial separators, the gas flow is made to change direction while suspended particles, because of their greater inertia, impact on collecting surfaces. The simple cyclones, wet scrubbers, fibrous filters, and electrostatic precipitators are examples of inertial separators. The electrostatic precipitator is the only general purpose device capable of removing particles in the micron and sub-micron size ranges. Getting collected materials out of the collector may require oil or water sprays to wash down collector plates, in the case of dust collectors. Heavy mist loadings sometimes flow continuously out of a collector.

"Mist and Dust Collection Equipment." By W. E. Ranz and C. Hofelt, Jr., Pennsylvania State University. *Industrial Wastes*, January-February, 1958.

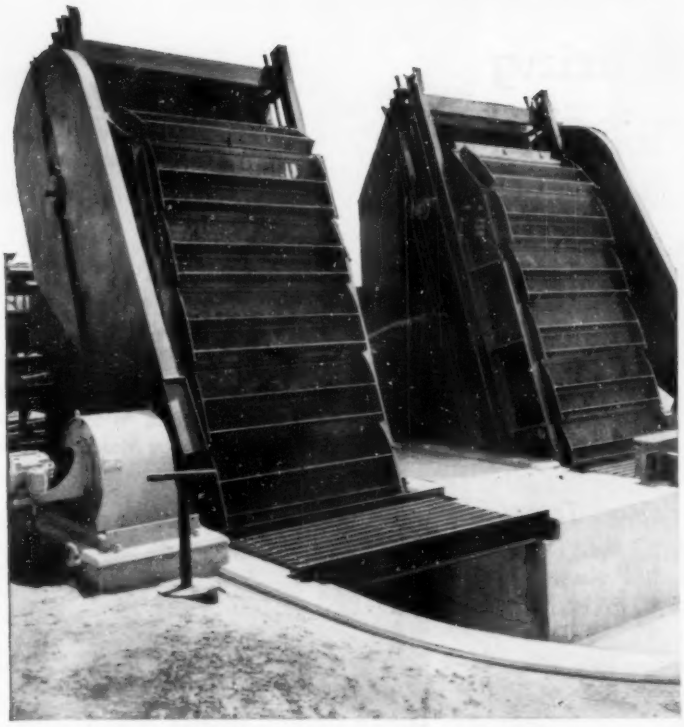
Surveys for Waste Treatment

Control of toxicity, discolorations, high BOD, or mineralization factors demand special survey attention which must look into processing plans, schedules of production, and research. The American Cyanamid Co. plant at Brewster, Fla., through a continuous program of monitoring stream conditions, starting a year before commencing new operations, is able to keep well informed as to progress in pollution abatement. A key to effluent problems in developing a new process was obtained in the research stage at the Company's laboratories at Stamford, Conn. During one pilot plant investigation, the City of Stamford reported that sewage from the laboratory had increased chlorine consumption in the sewage treatment plant. This was found to be caused by the presence of thiocyanate in the effluent of the new process. The research staff solved the problems on the spot with a change in the process. A comprehensive study has been made of the waste disposal problem for the process because time was made available to do so by the early attention given in the research stages.

"Planning a Water Survey." By L. L. Hedgepeth, A. J. Gabaccia, C. G. Mauriello, and H. W. Senn. *Sewage and Industrial Wastes*, January, 1958.

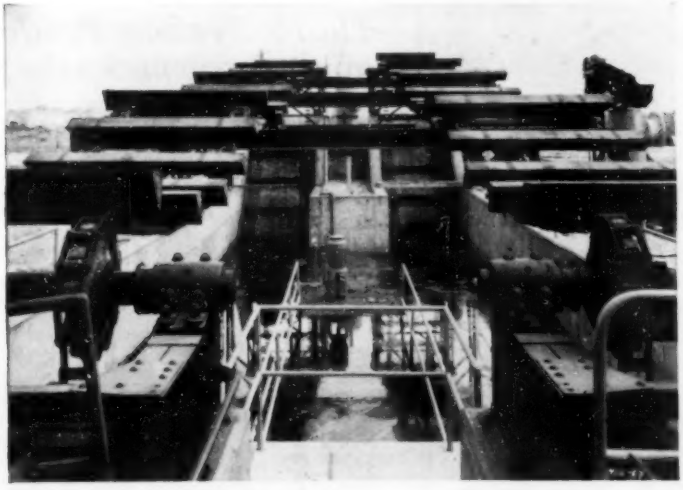
Other Articles

"Some Remedies for **Trade Waste Difficulties.**" By Harry Eaves. Design for balancing flow tanks are described. The Surveyor, January 4, 1958.



Traveling Water Screens handle 16,000 gallons per minute at 2 feet per second.

Grit Chamber removes bark, sand, gravel, small pieces of wood, and railroad ballast up to 2" in size.



Removes tons of sand and bark...

Reclaims 16,000 gallons of water per minute

Sandy soil and brutal service present two water problems at this Southern paper mill. Jeffrey screens take out 6½ tons of bark per hour. Jeffrey grit chambers remove 12 tons of grit as well as other debris deposited during log fluming operations.

Jeffrey engineers analyze waste problems and suggest sound solutions for recovery, disposal or neutralization. They design entire systems or work with your men on selection of equipment.

Jeffrey treatment plant equipment includes bar, disc and traveling water screens, grinders, collectors, washers, scum removers, feeders and FLOCTROLS... (controlled flocculation). Jeffrey supplies material handling and power transmission equipment for all or any part of your treatment plant.

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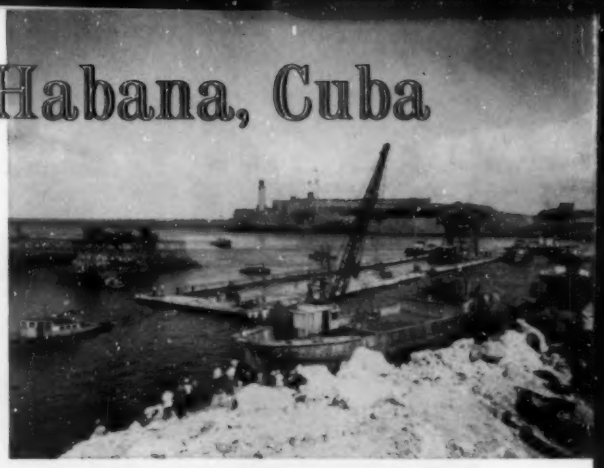
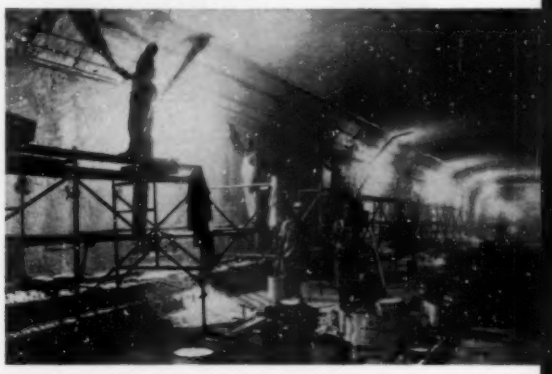


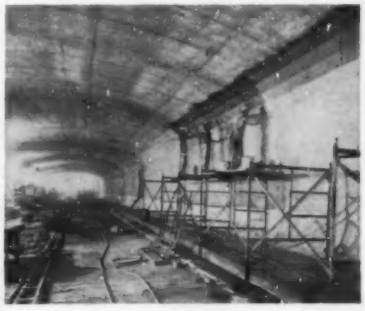
Four-lane, underwater tunnel, connecting Malecon Drive, City of Havana, Cuba with Guanabacoa near the famous Morro Castle, opening the sparsely-populated peninsula to residence and commercial activity.

Mammoth precast concrete sections are floated to location by attached pontoons, lowered 24 meters under water and connected to previously-sunken sections. ***Note the famous Morro Castle. Top, center background.***

Design, engineering and construction by Societe des Grand Travaux de Marseilles, Paris, France, 733 Meters Long, 23 Meters Wide, 7 Meters High, cost $28,500,000.00. Waterproofed inside and outside with THORO System products, THOROSEAL, WATERPLUG and THORITE.



From Havana side, tunnel entrance grades down to harbor pool level.



Thoro System Products applied, completes the job!

Preparing interior surface for WATERPLUG and one brush and one trowel coat of THOROSEAL. All walls, floors and ceilings are sealed with THOROSEAL.

Two double-lane tunnel sections take shape; forms will be filled with poststressed concrete.

THOROSEAL is being applied to all interior surfaces. Over 800 drums of WATERPLUG have already been used, where water was entering and where sections were joined together. All honeycomb and construction faults were sealed with THORITE Patching Mortar, before lowered to position in the bay.

Thousands of drums of THOROSEAL, WATERPLUG and THORITE Patching Mortar are being used on this vast project.

Precast sections of tunnel, honeycomb patched with THORITE Patching Mortar and entire surface protected with THOROSEAL.

Write for literature "HOW TO DO IT"

Standard Dry Wall Products, Inc.

NEW EAGLE, PA. CENTERVILLE, IND.

"Internal Housekeeping Cuts Wastes Treatment at Pickle Packing Plants." By G. E. Barnes and L. W. Weinberger. The authors believe that no treatment facilities should be built except those found necessary after other possible alternates have been explored. Wastes Engineering, January, 1958.

"Pollution Control at Shell **Oil Refineries.**" By L. C. Burroughs and G. E. Sample. Oil separation, air oxidation, neutralization of spent caustics are discussed. Sewage and Industrial Wastes, January, 1958.

"Behavior of Cyanates in Polluted Water." By J. D. Resnick, W. Allan Moore, and M. B. Ettinger. Cyanates are unlikely to be reduced to cyanides after discharge as water-borne wastes. Industrial and Engineering Chemistry, January, 1958.

• • •

Ohio Highway Construction and Improvements

Ohio Department of Highways announces that in 1957 $290 million was spent on their highway construction and improvement program. There were 453 miles of new construction which totaled $268 million. During 1957, 3072 miles of highways were surfaced and 6249 miles of highway were painted with an edgeline.

• • •

Refuse Collection in New Bedford

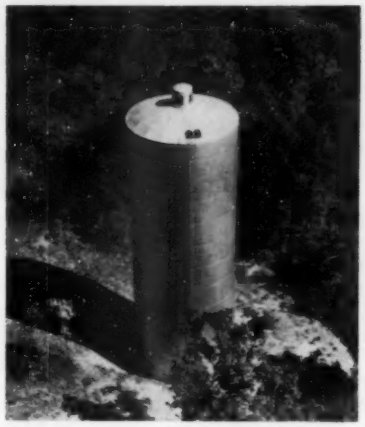
JOSEPH W. CARREAU,
Supervisor, Refuse Disposal Division
New Bedford, Massachusetts

The Board of Health of the City of New Bedford is responsible for the collection and disposal by incineration of all burnable rubbish and garbage. The people are required to keep separate barrels for nonburnable trash and this collection is made by the Department of Public Works.

Our city is divided into 45 sections with each of 15 trucks taking 3 sections each. Each section is one day's work. Thus it requires three days to serve the entire city once. We have a 5-day work week. The last two days of the week are spent repeating collections of the 1st and 2d sections on each route. The following Monday they begin on the section which got only one collection the previous week, so that householders have a rotating collection day scheduled thus—1st week Mon. & Thurs.; 2nd week Tues. & Fri.; 3d week

"High on the Hill" at Livingston, New Jersey

Utility



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N.N. Papandrea, Township Engineer

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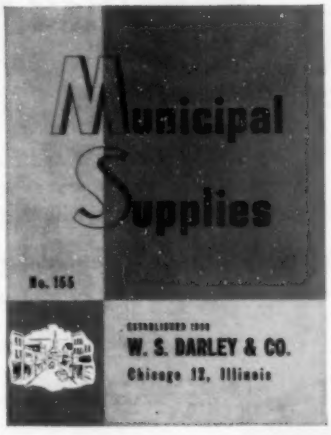

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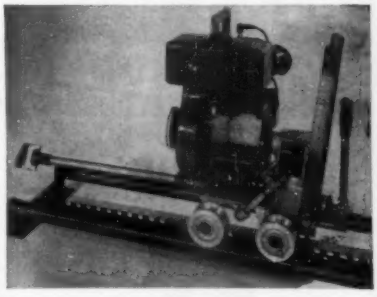

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- **BORES**—with no surface break
- **BORES**—up to 250 feet in length
- **BORES**—up to six inches diameter
- **BORES**—so drill stem of pipe of conduit stays
- **BORES**—1,000 feet on 1 Gal. of gas
- **REAMS**—up to 12 inches diameter

Write immediately for information.

Earthworm Boring Machine (Inc.)
Lube Jack Co.
1415—14th St. (P. O. Box 1100)
Santa Monica, Calif.

Wed., and then the cycle repeats. This applies only to the day collection for householders. To avoid traffic congestion, we also provide a daily collection at night after the stores have closed in the business districts. The same trucks used during the day are used at night, the only difference being that at night only 3 routes operate.

During the day, we use 11 packer type trucks (six 16-yd. and five 15-yd.) and 4 open body trucks. We estimate (no scales) a normal load to be about 7,000 lbs. Naturally, we find the 16-yard bodies more advantageous since they pack more than the 15-yarders. Possibly a 20-yd. body would be better for some, but since our packers are dumped inside the incinerator building, we are limited as the bodies when raised to dumping position come very close to the rafters.

During the day we collect from back yards. At night we collect from the curb. One crew is four men—1 driver and 3 helpers. With packer bodies, one man goes ahead and removes containers from yards to the curb; and two men behind the packer empty barrels into the hopper. With open trucks the same method is used except that the driver gets out of the cab at each stop to assist one man to throw the barrels up to the man standing inside the truck body who empties the barrels and passes it back down to the men on the street.

The average truck covers 45 miles in three day's work which constitutes one route. The average length haul to disposal is 3½ miles. At one time a count was made of stops made on a route in one day and for the particular route it was 525 stops.

The Board of Health requires householders to wrap all garbage. This not only entirely eliminates cost for auxiliary fuel to facilitate incineration, but also helps to keep barrels and trucks clean. The trucks are steam cleaned weekly; we use no chemicals on the trucks for controlling odors or insects.

Since we have no accurate weight records, and costs of operating packers are not kept separately from costs of operating open body trucks, no estimate can be given of comparative costs, but the following factors affect the cost of operating packers over open bodies: Initial cost higher; maintenance cost higher; operating costs higher (heavier chassis require more gas; power-operated packer requires more gas; some saving in gas, tires, and wear and tear in fewer trips to disposal); better distribution of labor theoretically necessitates fewer units but we find that expansion of the city more than nullifies this saving; fewer injuries, especially back injuries from lifting heavy barrels to high open body trucks; slight saving in labor since with packers no part of the load can fly or spill into the street.

• • •

Refuse Collection Methods

(*Continued from page* 93)

chemicals and insecticides. Kenosha, Wisc., C. R. Nicolazzo, Dir. of Public Works, spray-washes every night, and occasionally uses a sodium steam bath. Madison, Wisc., J. A. Brophy, Street Commissioner, hose-washes its trucks. In Racine, Henry A. Nelson, Commissioner of Public Works, trucks are washed once a week in cold weather and daily in hot weather.

Comments from Cities

Oakland, Calif.—The Oakland Scavenger Co. has the exclusive contract for the removal of all wet and dry garbage in the City of Oakland, Calif. Their office has answered most of the questions you asked; however, I will endeavor to give you some additional informa-

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F&E INCINERATOR STOKERS

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Designed and manufactured by a century-old concern with 40 years' experience in designing, engineering and completely manufacturing hydraulically-powered stokers.

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tion. The company operates about 80 trucks, seven of which are of the packer-type units. All truck replacements are made with packer-type equipment and in time will eliminate all open body trucks. The trucks used on dry garbage and refuse are cleaned with water while the wet garbage or swill trucks are cleaned with steam. Edward A. Tuchsen, Sanitation Superintendent.

San Bernardino, Calif.—The Refuse Disposal Department takes care of the collection of all refuse, including rubbish and garbage, within the city limits. Each resident is given twice weekly pick-up combination service. Each street is completely cleaned with one operation. The department operates on a six-day week.

We use a packer type truck for this service. We feel that it is better than an open box truck in hauling capacity. Using a modern sanitary packer eliminates several things that the public has previously objected to, as spillage on the streets, odors, etc. The appearance of the truck has been greatly improved, too, for we have painted them white with black lettering. The safety features of the truck have reduced accidents to a minimum.

Our department pays its own way, is self-supporting and does not depend on the tax dollar. Our charge is not a compulsory one, but strictly for those that request or use the service. We maintain a disposal site for those who wish to dispose of their refuse at no cost to them. At this site all refuse is buried in trenches and then covered with dirt daily, using a tractor. Raymond O. Powers, Refuse Superintendent.

Glendale, Calif.—At the present time we do not have any packer-type units in operation. We have on order nine 20-yd. and four 16-yd. units. These thirteen trucks will be mounted on 26,000 GVW chassis with right-hand drive and torque converter. We will also have one 24-yd. packer which is a front-end loader. This also will be mounted on a 26,000 GVW chassis with right-hand drive.

Our plans call for two trips per day per unit. We have no data on the number of pickups this will require. Ours will be a curb collection, with one driver and one swamper. The average round-trip will be approximately 4½ miles.

We are planning a wash rack to be set up to take care of our trucks daily. We do not anticipate the use of chemicals for odor control as

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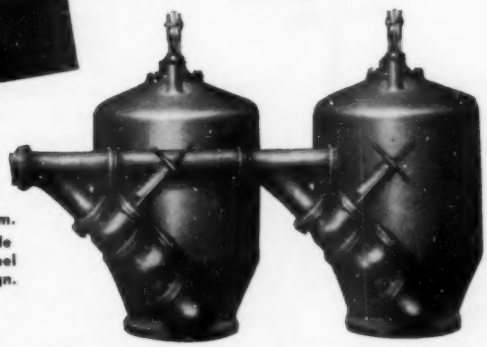
Pneumatic
Sewage Ejectors



Illustrated: Cast iron duplex 250 GPM system.
K-S Ejectors are available in cast iron or welded steel in single or duplex design.

The Komline-Sanderson Ejector:

Eliminates complex and intricate piping.
Provides economical operating features.
Offers electric or entirely pneumatic control system.

Write for catalog giving layout dimensions, piping diagrams and helpful information in the design of pneumatic ejector stations.
Bulletin No. KSM-2 available on request.

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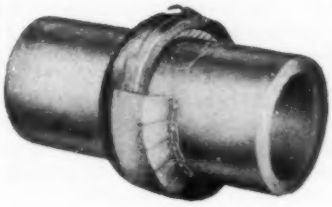
BUILD BETTER SEWER LINES



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SURE LOCATIONS EVERY TIME!

- NO WIRES, BATTERIES or SWITCHES—simple, powerful magnetic action, factory adjusted to YOUR geographical location assures unfailing results!
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- RUGGED—compact, accurate, convenient!

[illegible] LOCATOR!

these trucks will not be used for garbage pickup.

We have no data that we can give you on costs. Preliminary studies indicate that the City will not save any appreciable sum of money over private contract. However, we will have much better control of the personnel used in the collection and will be able to maintain better public relations thereby. Wm. L. O. Martini, City Engineer and Street Superintendent.

Waterloo, Iowa—The city of Waterloo, Iowa, owns 11 packer type units with the following loading capacities: Seven (one spare) of 9-yd. capacity; and four of 16-yd. capacity. In the 9-yd. units, we normally collect 4,670 lbs.; and in the 16-yd. bodies 7,260 lbs.

The change from 9-yd. to 16-yd. bodies has been most advantageous for our general use on an average route where our crews make 685 pick ups per day. We have an entire alley-pick-up and rear-of-house collection system and a garbage collection crew consists of a driver and 2 loaders. The average length of our collection route is 15 miles and the average length of haul to disposal is 4 miles. Garbage trucks are cleaned very thoroughly by using a high pressure water hose. So far we have not used any chemicals for controlling or masking odors from the bodies. The collected garbage is picked up, disposed of and compacted so fast that application of chemicals has not been necessary. We do not treat our truck with insecticides, but pest control our city disposal area in summer. The city recently purchased four new 16-yd. units and these units are giving us better service and ability to meet the requirements of our fast growing city. Cost figures on maintenance and operation prove that these new units have brought about a saving figured roughly at $7.50 per day/per crew. Carl C. Fagerlind, Street Commissioner.

Bay City, Mich.—It is the policy of Bay City, Michigan, population approximately 55,000, at the present time, to have the city collect all kinds of trash, limbs, tree and lawn clippings and similar refuse; but the city does not collect garbage. This is done by private contractors on a bi-weekly basis.

Five open trucks with specially built bodies, but not the load packer type, are used for this collection work. The city owns a central dump, an island in the Saginaw River, which is located in the center of [illegible]. Approximately 8 cubic yards

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The Jefferson with its new facilities for handling all convention groups is fast becoming Atlantic City's most popular convention hotel.

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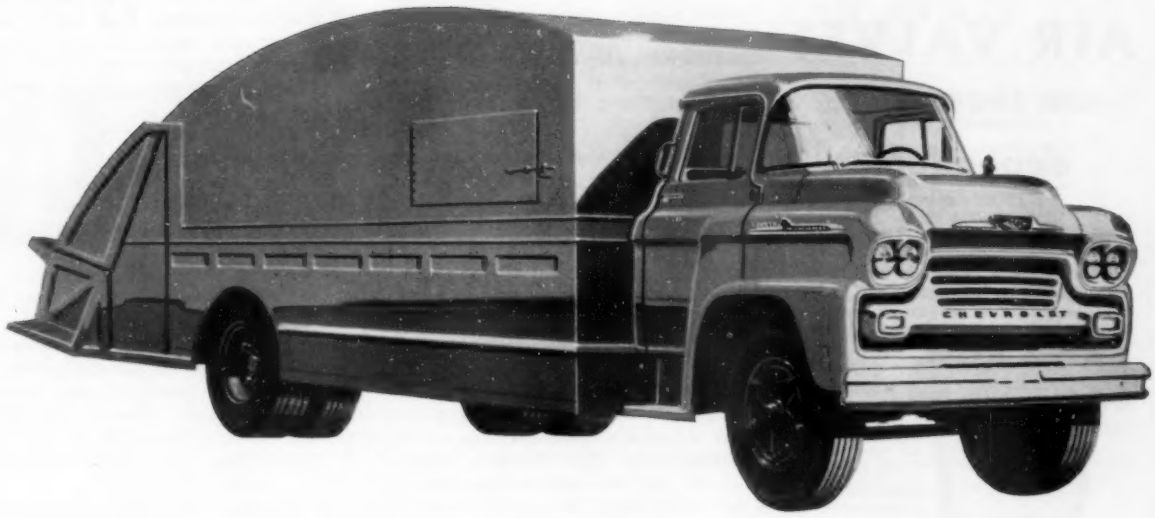

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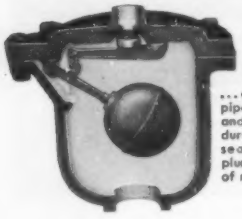

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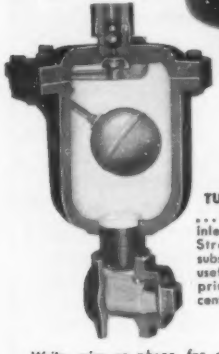

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are carried in the open type trucks. Collection is from the curb line and the property owners are required to put the material in containers on their scheduled day. There are two men assigned to each truck, a driver and a helper. The average length of a collection schedule is approximately 3 miles. The average haul to the dump is approximately 2 miles. The trucks are cleaned with hoses at night with water. No chemicals are used. The cost for this work per year is approximately $65,000.

We encountered particular problems picking up brush with the load packer type of equipment and, as a result, from an economy standpoint are using open-type trucks. We realize that they are not as satisfactory as the packer type trucks, particularly during a high wind. However, due to the short haul we find a considerable savings with this type of equipment. The cost last year per residence amounted to $5.03. R. K. McGillivray, Director of Public Works.

Lansing, Mich.—The city of Lansing does not own or operate a single refuse collection vehicle of the packer type. Our refuse is picked up in the can and a clean can is left in its place. We use stake trucks in this operation. William C. Waidelich, Public Service Department.

Springfield, Mo. — The packer-type truck is very satisfactory. It is impossible to overload the trucks with dry-wrapped garbage. Two men are assigned to a truck for an 8-hour day. Each unit gets approximately 500 pick-ups per day from the back doors and alleys. The men dump the refuse and clean their trucks during the 8 hours. A detergent and hose wash is used to clean the trucks. Trucks will average 20 miles per day on routes and cover the routes twice weekly. W. Raymert Miller, Ass't. Director of Public Works.

Lincoln, Nebr.—Garbage collection is handled by private collectors hauling to a city operated sanitary landfill. There are no packer type trucks in use in Lincoln at the present time. James H. Ager, Sup't. of Parks.

Schenectady, N. Y.—In 1955 the open trucks and small packers delivered to our incinerator a total of 11,302 loads or 20,581 tons; and in 1956 our large 20-yd. packers delivered to our incinerator a total of 8,710 loads or 21,737 tons of burnable material. As you can readily see by this comparison, our larger trucks are kept on route longer and obtain more production instead of traveling back and forth to our incinerator. Charles J. Leonard, Sup't., Waste Division.

Charlotte, N. C.—The initial cost of packer-type equipment is more than double the cost of a conventional open type truck. The per mile operating cost is normally double the cost per mile of the operation of the conventional type truck. In our particular operation we often require the supplemental use of a conventional truck for limbs, large crates, discarded appliances, etc., that cannot be successfully handled in the packer-type units.

On the other hand the easier loading results in fewer personal injuries, less spillage and less odor; and the better looking unit has, in my opinion, some public relations value. These are intangibles that I am not in a position to evaluate; however, we consider our cost based purely on dollars and cents greater for the packer than for the open type trucks rather than a possible savings. O. C. Fogus, Sup't. Motor Transport Dep't.

Alexandria, Va.—This City has saved an average of $3,600 per truck a year using the packer type. We have found that a packer type truck equal in size to the open type of truck can cover twice the route per load per truck and provide a much cleaner operation. R. S. Mangum, Sanitation and Service Engineer.

Kenosha, Wisc.—The thing that should be pointed out regarding packer-type collectors is that they are more economical to operate. It is necessary to make fewer trips to unload, whether the units are used for collection of garbage or refuse or both; and when properly operated, they are capable of handling from 2 to 2½ tons, which is greater than the load that any of our other trucks could possibly handle. During the course of one day's time, they make only one trip out to the job in the morning and one back at noon for lunch and one out in the afternoon and a trip in at quitting time; thus much non-paying travel time is eliminated. All of our trucks have 16-yd. capacity and I have found that with the exception of four or five times during the course of a full year, it is impossible during the course of one morning to fill completely one of these units so that it is necessary to unload before lunch time.

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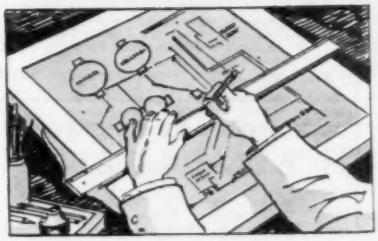

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There is one situation we have found which is detrimental to the use of packer-type trucks. That is the fact that, because of various operating rules and lack of strict control of the men, these units are not operated as efficiently as they should be and as efficiently as we have noted is being done by some private collectors. The use of these units has been a savings to the city in that they make only two trips out and two trips in, thus saving a great deal of wear and tear on the equipment and travel time of the men. This makes them less expensive to operate than our other garbage collection equipment. However, if the men would operate these units as efficiently as the units are able to be operated, we feel that the use of packer-type collectors would save the Waste Department a great deal of money. C. R. Nicolazzo, Director of Public Works.

Racine, Wisc.—The Department of Public Works of Racine has a garbage division and a rubbish division, which are independent of one another, each having a foreman and a separate fleet of trucks. Each division has fourteen trucks to make their weekly pick-ups which are somewhat identical, but collection day will vary with the division. We operate on a 40-hour week basis with 2-man crews.

The garbage division picks up garbage (which includes animal, fruit and vegetable refuse) and other combustible waste and delivers this to the incinerator plant where it is burned. The garbage division has 13 packer units of 10-yd. capacity and only one hopper unit of 11-yd. capacity. The 10-yd. unit is the most advantageous for this division because of operational problems in the incinerator, where we have no storage facilities and therefore must have scheduled times for trucks to report for unloading. The average garbage route has 250 to 350 pick-ups per day, reporting at the incinerator four times and averaging 2500 pounds per load. About 60 percent of the pick-ups are at the back door, and the remainder are alley stops. The average length of haul to the incinerator is two miles, with an average length of collection route per day of fifteen miles.

The rubbish division picks up ashes and non-combustible material and delivers these to the sanitary landfill where they are covered with dirt. The rubbish division has eight packer units (six 16-yd. and two 13-yd.) with the remaining six units being the hopper type. The 16-yd.

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packer unit with an average collection weight of five tons per load, has been found to be the unit that best serves this division. The average rubbish route has 250 to 350 pickups per day, with the collection being sixty percent backdoor and the remainder alley stops, with a few curb collections. The average length of haul to the sanitary landfill is about three miles, each truck making two trips daily with an average length of collection route of twelve miles per day.

The trucks are housed at a central garage and maintenance is done at the central shop. The trucks are washed with water once a week, except during hot weather when it is done daily. We use no chemicals for masking odors from the trucks, and we do not treat the trucks with insecticides.

I have no figures recorded as to estimated savings in cost for packer-type trucks over open trucks; but there are several reasons we prefer the packer-type units. (1) They collect more material per load; (2) there are fewer trips to the unloading station; (3) easier loading; and (4) the collection is hauled in enclosed trucks—no dust, no spillage, no unsightly vehicles. Henry A. Nelson, Commissioner of Public Works.

Ogden, Utah—At the present time we have seven 12-yd. and one 20-yd. compaction bodies and in addition we have two open bed trucks used for stand-by service. The 12-yd. trucks average about 2½ tons per load and the 20-yd. truck will average about 4 tons per load. The 20-yd. truck, of course, cuts down on trips to the dump and the body practically eliminates spillage. The lift is slightly higher but the loaders do not complain due to the other advantages.

● ONE of the collection vehicles used by the City of Orlando, Florida.

Each truck route now averages about 560 pickups a day per truck. These are 95 percent residential with a few semi-commercial pick-

ups. All commercial pickups are handled by private haulers.

Pick-ups are made at the curb, with restrictions as to size, type and classes of containers, and are limited to household garbage and normal yard litter, grass rakings, etc. Leaves, tree trimmings, building materials, large refuse, etc., are not acceptable. These are picked up by the Street Department clean-up crews in the spring and fall at a designated date.

The department has a normal personnel of 18 loader-drivers, with two tractor operators for the landfill. This allows two men to the truck. We also utilize some prison trusty labor (who get 2 days credit for each day worked on city detail).

The average mileage from route to dump is 6 miles per truck. Some extreme fringe routes run as high as ten miles. The average mileage for each daily route will also run about six to seven street miles. The trucks are cleaned with hot water and special detergents and are sprayed regularly with a creosote solution for insect and odor control.

According to departmental records, the old type open trucks with oversize beds and partial covering, operated at a lower cost per ton-mile than the present trucks. However, the old trucks constituted a health hazard, littering the streets and spilling refuse. In 1956, with an operating budget of only $95,292 for this department, the average taxpayer was afforded this weekly pickup service for a total cost of only 13¢ per month. Inasmuch as this service in many surrounding cities is handled on a monthly service charge of from $2.50 to $7 per month, we feel that the Ogden City tax payers get a real bargain.

Our records show that over a hundred million pounds of refuse was hauled from Ogden homes during 1956. All of this was immediately covered and packed with sand, gradually reclaiming a large area of swamp and river bottom land adjacent to a rapidly developing industrial area. The population in Ogden has increased more than 10,000 since the 1950 census. In the five years of Council-Manager administration, Ogden has added more than 40 miles of city streets; built a million dollar water treatment plant; become a top city in the nation for city health and sanitation; lowered the crime rate; and jumped two points in the National Fire Underwriters' scale to save $100,000 a year on fire insurance premiums for the taxpayers. William M. Anderson, Sup't. of Garbage Disposal.

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EQUIPMENT NEWS

30-Degree Elbow For House Sewer Systems

A new 30° building sewer fitting, featuring maximum tightness nd protection against root penetration, has been developed by Johns-Manville to give greater leeway to designers of house systems. The epoxy-bonded elbow, newest addition to the J-M line of Transite building sewer pipe, is made of asbestos-cement. It embodies the Ring-Tite coupling principle that assures tightness by compressing two rubber rings between the pipe wall and the fitting or coupling. This principle already has gained wide acceptance in mainline water and sewer service as well as for house connections. When added to the present line of elbows and bends, both of which come in 11¼°, 22½° and 45° turns, the 30° fitting will allow a much greater margin of design freedom in laying out house sewer systems. For more data write Advertising Department, Johns-Manville, 22 East 40th St., New York 16, N.Y., or circle **No. 3-1.**

New 30-degree building sewer fitting

All Transistor Pipe Finder-Leak Detector

Easier pipe finding and leak detecting is promised through use of an all new transistorized M-Scope combination pipe finder-leak detector. This new detector combines the advantages available through new electronic techniques and materials. Transistors, printed circuits, indestructible Fiberglas cases and single turn solid aluminum detecting loops are a few of the new materials used. Transistors, in addition to their many other advantages for field detectors, provide exceptional battery economy. The battery life in this new unit is estimated to be 1500 hours of continuous operation. Operating weight complete is 12 lbs.; color bright red, maroon, and silver; shipped complete with batteries and ready to operate. For more information contact Fisher Research Laboratory, Inc., Palo Alto, Calif., or circle **No. 3-2** on the reply card.

Detector combines all the advantages available through electronic technics

High Capacity Machine For Soil Consolidation Tests

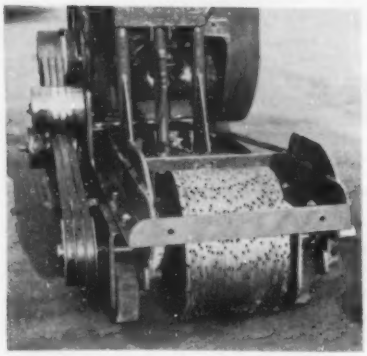
Consolidation test loads of up to 6000 lbs. are applied instantaneously and maintained indefinitely with the new Model 354 KW Conbel announced by Tinius Olsen. It may be used with only standard consolidometer for evaluating the amount and rate of soil settlement under load. Positive load application is assured, because a pressure gauge shows exactly what load will be applied before it is imposed on the specimen. Two ranges are provided for convenient operation. The low range is used for loads to 1500 lbs. (25 percent capacity), and the high range is for loads to 6000 lbs. Designed for table top use, this semi-portable unit measures 17 ins. long x 14 ins. wide x 28 ins. high, and weighs 130 lbs. It has a total vertical stroke or movement of two inches. Additional information is available from the Tinius Olsen Machine Co., 7791 Easton Road, Willow Grove, Pa., or circle **No. 3-3** on the reply card.

Rubber Expansion Joint

Development of a unique rubber expansion joint designed to eliminate the rhythmic road shock motorists encounter on many highways and to make smoother aircraft landings possible on airport runways has been announced by B.F. Goodrich. The joint is made of a man-made rubber specially compounded to absorb movement of the highway or runway in cold and warm weather. A series of metal plates are bonded to the rubber to carry the vertical loads imposed on the joint by traffic. Anchored between road sections for a water-tight seal, the joint is about 13 inches wide, and extends the width of the highway or runway and fully fills the joint connection to its required depth. For more details write Public Relations, B.F. Goodrich, Industrial Products Co., Akron, Ohio, or circle **3-4** on the reply card.

Goodrich expansion joint for highways

Traffic Paint Remover



A traffic paint remover attachment for the Concut concrete saw is now available. The unit is made to cut with a control of depth to follow contours both vertically and horizontally. It has a diamond cutting surface and the unit can also be used to serrate pavements for non-skid surfaces. For more details write Concut Sales, Inc., 1845 Belcroft St., El Monte, Calif., or circle **No. 3-5** on the reply card.

60-Cycle Generators Improved

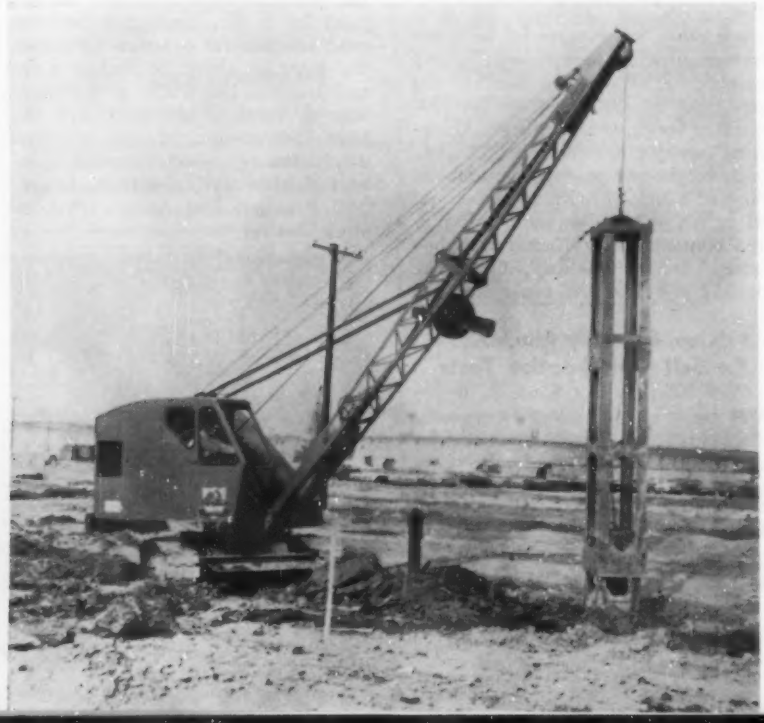
Engine-generator assemblers have endorsed the many recent improved design features of the single bearing and two bearing close-coupled 60 cycle Kato generator line for adaptation to commercial gasoline and diesel engines. The 60-cycle, 3-phase line extends from 400 watts to 5000 watts in revolving armature type and up to 400 kilowatts in revolving field type. The closely related 50-cycle line extends to 350 kilowatts. Single phase, 60-cycle alternators are available as large as 100 KW. More details from Kato Engineering Co., Mankato, Minn., or circle **No. 3-6** on the reply card.

Dynel Fabrics Help Cut Costs In Filtering Swim Pool Water

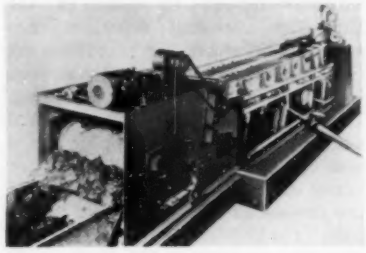
Increased efficiency and reduced costs in purifying water for swimming pools are reported by Landon, Inc., through the use of Dynel filter fabrics. Woven of Dynel, the fabrics are employed in Landon's vacuum-type "Lanco Skim-Filter" to retain a filter medium of diatomaceous earth or volcanic earth. Water pumped from the pool is mixed with these purifying elements and circulated around a series of plastic plates covered with Dynel fabric. This closely woven cloth retains the filter medium and impurities but permits a free flow of clean water to return to the pool. Highly resistant to chemical action, the cloths are unaffected by muriatic acid, sodium hypochlorite and algacides used in purifying swimming pool water, the company states. Moisture does not weaken the fiber and, because of its good wet strength, filter fabrics require no special care and can be handled by unskilled persons during maintenance operations. For more data write Textile Fibers Dept., Union Carbide Chemicals Co., Div. of Union Carbide Corp., 30 East 42nd St., New York 17, N. Y., or circle **No. 3-8** on the reply card.

Tamper Attachment For Schield Bantam Crane

Schield Bantam has announced the availability of a specially designed tamper attachment for its complete line of power crane-excavators. One of the outstanding features of the tamper is the fact that it offers 80-100 percent compaction at a maximum penetration of three feet. With the Bantam tamper method, only three full-lead passes at a given point in average ground will bring full compaction and virtually assure meeting compaction specifications. The tamper is quickly interchangeable with any of Bantam's other nine attachments on all three equipment models. Complete information is available from Schield Bantam Co., Waverly, Iowa, or circle **No. 3-7** on the reply card.



Sludge Dewatering by Vibration



Vibration principle in this process is responsible for a change in the physical structure of raw or treated sludge

The German-made Heymann sludge thickener, a mechanical sludge dewatering process, in use in numerous sewage treatment plants in Germany and Switzerland, has been patented in this country and is now being offered for sale by Sonic Separation, Inc. A recent installation in the United States has been made at West Paterson, New Jersey. Depending primarily on a vibration principle, said to be responsible for a change in the physical structure of the sludge, the process avoids the use of chemicals, heat or additives and minimizes the necessity for using lagoons, digesters and sand beds. Low cost of installation and operation is claimed for this method of sludge disposal. The process involves passing raw or digested sludge over a vibrating screen and through a roller press, resulting in a final total solids content of 26 to about 35 percent and almost complete elimination of odor. For more details write Sonic Separation, Inc., P. O. Box 37, Lake Hiawatha, N. J., or circle **No. 3-9** on the reply card.

Aerial "Worker" Basket Adds To Crane Versatility

A fully-insulated, Aerial "Worker" basket, designed for use as an attachment on their Vera-Lift "400" truck mounted cranes, has been announced by Teale and Co. The tough, new fiberglass basket is attached to the self-leveling elevator platform through six insulators, four at the bottom and two at the side. It will withstand continuous contact with a 12,500-volt line, or a brush contact with 50,000 volts. The basket is 48-ins. high, with an inside base 16 x 16 ins., and a top 24 x 24 ins. Used on the Versa-Lift truck-mounted crane, the basket enables lifting a man to a comfortable working height of 36 ft. with complete safety. For further information write Teale and Co., Box 308, Omaha, Nebraska, or circle **No. 3-10** on the reply card.

Unconfined Compression Soil Testing Machine

A new portable hand driven machine for performing unconfined compression tests on soils has been announced by Soiltest. The machine includes a recording system that provides a permanent record of all tests performed. In operating the machine, the specimen to be tested is loaded axially by means of a calibrated spring arrangement. The lower end of the spring is compressed by means of a lead screw driven by a pair of spiral bevel gears. An arm extending from the upper spring platform slides horizontally in a 4 to 1 ratio of amplification of the compression of the specimen. The vertical movement indicated by the recording pencil on the chart is a measure of the load being applied to the specimen. For additional information write Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., or circle **No. 3-11** on the reply card.

Industrial Mixer and Pump

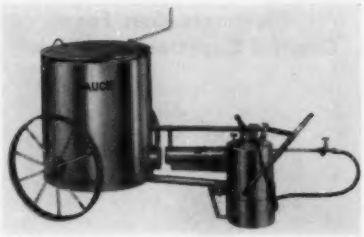
A portable, low-cost industrial mixer and pump is now available from Led Ballast. The unit will mix and pump fluid materials such as glue, hot asphalt and heavy slurries of various compounds. Built in two sizes, the #100 has a material capacity of 2 cubic feet and the #600 has a capacity of 8 cubic feet. More details from Led Ballast, Inc., 1331½ Arapahoe St., Boulder, Colo., or circle **No. 3-12** on the reply card.

Lightweight Magnesium Curb And Gutter Forms

Magnelite curb and gutter paving forms developed by Dotmar Industries are made of strong magnesium alloy. These forms are easy to handle, place and transport. One man can carry two forms 12 ins. by 10 ft. long. Weight per curb form is 47 lbs. For complete information write Dotmar Industries, Inc., 521 Hanselman Building, Kalamazoo, Mich., or circle **No. 3-13** on the reply card.

Compound Melting Furnace With Agitator

A new item in the line of portable furnaces manufactured by Hauck Mfg. Co. is the Series MCO melting furnace equipped with agitator. It is used for melting and heating all kinds of joint compounds for water and sewer lines, electrical pipe compounds, protective coating enamel, asphalt, pitch and tar. The removable heavy steel pot of 25-gallon capacity is available with a built-in 4-blade agitator which is rotated by a hand lever at the top of the pot. Use of the agitator assures uniformly melted material and cuts maintenance. Keeping the pot clean by the agitating and scraping action on the bottom results in faster melting. For more data write Hauck Mfg. Co., 135-145 Tenth St., Brooklyn, N. Y., or circle **No. 3-14.**



Furnace has a 5-gallon steel fuel tank

Galion Combination Grader and Electric Vibratory Compactor

Galion is now offering the model 503 motor grader and a Jackson electric vibratory compactor as a dual purpose unit for maintaining, leveling and compacting. The combination grader-compactor is sold only as a complete unit. The vibratory compactor consists essentially of the proper assembly and suspension of four 26-in. wide electric vibrating compactors. The compactor workhead is connected by drawbars to the head block of the grader. The grader is adequately protected against the vibration of the compactors. Raising and lowering the compactor is by hydraulic control from the grader operator's platform, permitting high speed mobility on the job and between jobs. This compactor is claimed to deliver 4200 three-ton, deep-penetrating compacting blows per minute; and compactive effort is said to be so effective that specified densities are often obtained in only one pass on granular soil bases, subbases, large fills, and all materials normally used in macadam bases. For complete information write The Galion Iron Works & Mfg. Co., Galion, Ohio, or circle **No. 3-15** on the reply card.

Compactor on the Galion grader is easily removed to permit full grader operations

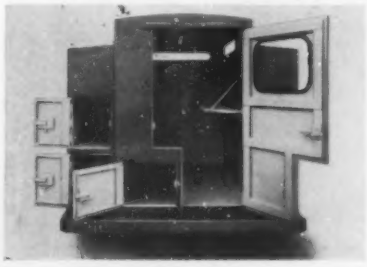
Blastcrete Gun For General Construction Work

Gun can produce 13 cu. yds. per hour

The Blastcrete Equipment Co. announces a new and larger model to their line. This model, like all previous models, handles very damp materials. The gun has produced over 13 cubic yards per hour. For more details write The Blastcrete Equipment Co., Inc., Los Angeles 11, Calif., or circle **No. 3-16** on the reply card.

Maintenance and Construction Trailer

Trailers from Stahl Metal Products have compartments that are designed for the carrying of tools and materials to and from the job. Compartment doors are equipped with flush door handles and locks, keyed alike. The trailer is equipped with an adjustable landing gear which makes it very easy to attach the trailer towing ring to a passenger car or truck for towing. An adjustable rear jack serves to stabilize the trailer when parked on the job and interior space in the trailer provides a cushioned seat arrangement for the seating of 3 men. For more data write Stahl Metal Products, Inc., 3490 West 140th St., Cleveland 1, Ohio, or circle **No. 3-17** on the reply card.



Maxon Announces New Dumpcrete Spreader

A new unit, named the Dumpcrete spreader, is designed to work with the Maxon Dumpcrete body. The spreader can take a 4½ cu. yd. load of concrete from a Dumpcrete body, spread a 20-ft. to 26-ft. wide slab, strike-off and be ready for the next load in less than 90 seconds. More information is available from the Manufacturing Division, Maxon Construction Co., Inc., 2600 Far Hills Avenue, Dayton 19, O., or circle **No. 3-18** on the reply card.

Concrete Saw By Clipper

The Clipper Mfg. Co. announces a new concrete saw, the Model C-180, that features a 23 percent increase in power, over the C-146, which it replaces in the Clipper line. The machine uses an 18-hp Wisconsin engine, with a more powerful transmission, which delivers greater torque to the drive wheels. The increased horsepower means faster sawing, longer blade life, and greater engine life, and has been achieved

Saw will not bind or twist in cutting

with no sacrifice in maneuverability. Clipper's 3-point no-bind blade suspension, with four wheels and pivoting front axle, keeps the blade straight and true in the cut, even on rough, irregular surfaces. This prevents binding, twisting, or drifting in the cut. You can line-up and saw in seconds. Another feature, the positive screw feed, raises and lowers the blade smoothly in and out of the cut without bumping and scraping. For full details write Clipper Mfg. Co., Suite 226, 2800 Warwick, Kansas City 8, Mo., or circle **No. 3-19** on the reply card.

Miller Bituminous Curb Builder

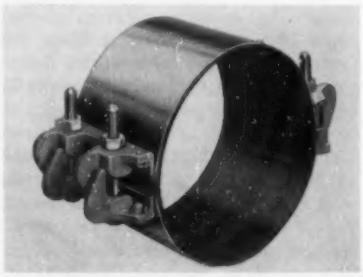
More speed and smoother curb are results obtained in using the new Miller Curbilder, made by Miller Spreader. The curb extruding machine features porcelain vitreous

Machine lays a smooth asphaltic curb

enamel lining on the inside of the curb form. This glassy surface provides a smoother troweling action and produces bituminous curb with a smooth surface. Eight to fifteen feet of bituminous concrete curb per minute can now be extruded depending on the size of curb being made. In addition to the porcelain lining, new curb forms are tapered one-half inch to provide greater compaction and a more solid curb. For more information write Miller Spreader Corp., Youngstown, Ohio, or circle **No. 3-20** on the reply card.

All-Around Repair Clamp

Efficient, quick, economical water and sewer line maintenance is now possible with the new Dresser "360" all-around repair clamp. Made of 20-gauge stainless steel and Grade A malleable iron, this clamp provides an easier-to-install and efficient method of repairing full breaks or holes in asbestos-cement and cast iron water lines. To use, remove the bolts from one side of the clamp, spring the clamp around the pipe, insert the bolts and tighten the nuts. The steel track head bolts have rolled threads for greater strength. Track head bolts prevent the bolt from turning as nuts are drawn up. All bolts are galvanized to ASTM standards for corrosion resistance. For further details write Dresser Mfg. Div., Bradford, Pa., or circle **No. 3-21** on the reply card.

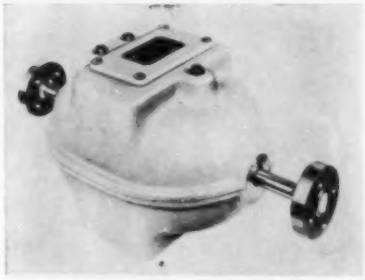


Clamp repairs breaks in water lines

Yard Handling Equipment Unit

A new yard handling equipment unit being produced by Anthony Company is specially adapted to material handling in maintenance, construction and equipment yards. The unit, which is capable of lifting 5000 pounds, can be installed on either wheeled or track type tractors by bolting directly to the chassis. The high pivot point of the boom, which is made in lengths of from 12 to 16 feet, permits full use of the tractor body in loading and unloading. Adjustable guy lines permit lengthening of the boom to any elevation and spotting loads where desired. The boom swings 280° and can be mounted in an 18-in space. The tractor on which the unit is mounted is stabilized by four heavy duty side mounted, valve controlled, double acting, hydraulic outriggers. These can be retracted when the tractor is travelling. For complete information write Anthony Co., Streator, Ill., or circle **No. 3-22** on the reply card.

Magnetic Flow Meter For Half-Inch Lines



Unit can measure flow rates of 3 gpm

Previously limited to a minimum line size of 1-inch the magnetic flow meter, made by Foxboro, is now available for ½" flow lines. It will be particularly useful in ratio flow control systems where small flows are ratioed to larger ones. The smaller meter offers the full advantages of the larger instruments; namely, over-all accuracy of 1 percent of full scale throughout the entire scale, no restriction of flow, linear flow readings, and performance unaffected by pressure, viscosity, density or changes in conductivity of the flowing liquid. The transmitter unit consists of a Teflon-insulated nonmagnetic flow tube containing flush-mounted metallic electrodes and surrounded by an AC electromagnet. Flow rates as low as 3 gpm can be measured by the new instrument. Complete information from The Foxboro Co., Foxboro, Mass., or circle **No. 3-23.**

Fluorescent Lighting Standard

New all-purpose fluorescent Circa-Lite

A lighting device called "Circa-Lite", uses standard 40-watt circular fluorescent lamps that are available everywhere. As many as 8 lamp "modules" can be installed on each standard, just by plugging the modules into each other. Thus the lumen output can be varied from 2500 to 20,000 lumens to meet various lighting requirements. Designed especially for parking lots and outdoor area lighting, the "Circa-Lite" is simple to install and to maintain. All parts are fabricated from aluminum, including the standards, which are high-strength aluminum extrusions available in mounting heights to 20 feet. A choice of three base types is offered, one of which is hinged so that the luminaire may be serviced from the ground. More information from The Kenworth Co., Winsted 1, Minn., or circle **No. 3-24** on the reply card.

John Deere Industrial Tractors and Equipment

Two new tractors—a crawler and a wheel-type—and several new major items of matched working equipment, all designed and built for highway maintenance and construction, are announced by John Deere. A noteworthy feature of the new 440 series tractors is the way they combine clean-cut, aggressive lines with new heavy-duty, well-balanced construction throughout. Room is provided between the grille and the engine on the crawler for front-mounted, crankshaft-driven pumps. The streamlined, full-view hood is of heavy steel plate; side frames are of extra-heavy welded steel construction. The 440 wheel-type tractor has a new heavy-duty front axle and support. Built-in power steering for this model is optional. John Deere has the gear-type direction reverser on tractors of 30 hp and under and the new clutch-type direction reverser, optional equipment for both 440 series tractors. This device permits the operator, with a touch of the lever, to go ahead or back up in the same speed without shifting transmission gears. The working equipment for the units include a new heavy-duty loader for the crawler, two new bulldozers for the crawler, and a new front-end loader for the wheel-type tractor. For full details write John Deere Industrial Div., Deere & Co., Moline, Ill., or circle **No. 3-25** on the reply card.

Optical Plummet Added To New Gurley Line

A second optical plummet transit, Model OP-137, has been added to the new transit line manufactured by W. & L. E. Gurley. The new transit is an adaptation of the Model 132 Gurley standard precise transit. The OP-137 is recommended for general engineering, many types of surveys and construction work—because of its shorter telescope, smaller size and lighter weight. The built-in optical plummets save as much as two-thirds the time in setting over a point. By rotating the instrument 180°, the surveyor is assured of positive centering. The model is furnished with a specially-designed Gurley tripod which has a built-in shifting head. Both transits allow a two-inch shift of instrument over the point, providing a greater latitude in initial set-up. More information from W. & L. E. Gurley, Troy, N. Y., or circle **No. 3-26** on the reply card.

Optical plummet is a telescope through the vertical center of the transit. It saves time in setting the instrument

Advanced Design Henry Mark II Backhoe

Backhoe can be detached quickly, making it possible to use tractor for other work

Featuring advanced design, the new Henry Mark II backhoe was recently introduced by the Henry Mfg. Co. Capable of digging to a depth of 12 ft. 6 ins., with a loading height of 8 ft. 6 ins., the new Henry Mark II backhoe digs with 20 percent more power than former models at any angle within a 200° arc of swing. It also offers a continuous swing of 200 degrees and faster, smoother control. Operating at high pressure, this backhoe has crowd, bucket, and swing cylinders of 3½-in. bore with 2-in. chromed rods, and a boom cylinder of 4 inches bore with a 2-in. chromed rod. Individual controls also operate the hydraulic outriggers. One new feature of the Mark II is the streamlined boom, designed to enclose the boom cylinder and hydraulic hoses. For further details write Henry Mfg. Co., P. O. Box 521, Topeka, Kans., or circle **No. 3-27** on the reply card.

Increased Ratings Announced For R-C Blowers And Gas Pumps

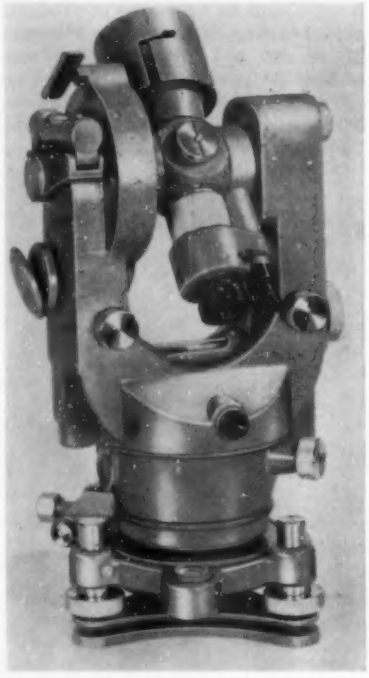
Substantially increased capacity ratings have been announced by Roots-Connersville Blower, for the full line of type AF rotary positive blowers and type XA rotary positive gas pumps. Type AF blowers are supplied in 18 sizes and capacities to 920 cfm for service from 1 to 10 pounds pressure. Type XA gas pumps are available in 18 sizes and capacities to 880 cfm for services from 1 to 7 pounds pressure. More information from J. L. Hylton, Roots - Connersville Blower, 1200 Mount St., Connersville, Ind., or circle **No. 3-28** on the reply card.

AWWA Standard Gate Valves

AWWA standard iron-body double-disc gate valve with O-Ring construction and mechanical joint ends is available from Kennedy Valve. The two O-Ring seals are Buna N synthetic rubber compound of 70 Durometer hardness. These are assembled into the stuffing box which forms the top thrust bearing for the stem collar. The stuffing box is secured to the valve bonnet with rustproofed steel bolts. The top O-Ring is the dirt seal and the lower O-Ring is the pressure seal eliminating any need of further adjustment. O-Rings provide an excellent seal, preventing any binding of the stem and resulting in very easy valve operation. Mechanical joint ends are available in sizes 3 through 13 ins. Kennedy can supply valves with mechanical joint ends through 48-in. sizes. For complete details write Kennedy Valve Mfg. Co., Elmira, N. Y., or circle **No. 3-29** on the reply card.

AWWA Kennedy valves have inside screw, non-rising stem, parallel seats

Wild T-1 Repeating Transit



Wild transit for highway departments

The new Wild T-1 optical repeating transit is ideally suited for all land, highway and heavy construction surveying. Combining speed, accuracy and ease of operation, the Swiss precision unit provides at-a-glance readings in the microscope mounted next to the telescope. With the internal optical micrometer, both circles may be read directly to 20 seconds, with easy interpolation to 10 and 5 seconds between graduations. Set up time is greatly reduced, especially on windy days, by use of the optical plummet. More data from Wild Heerbrugg Instruments, Inc., Main at Covert Streets, Port Washington, L. I., N. Y., or circle **No. 3-30** on the reply card.

NEWS OF ENGINEERS

A. N. LAIRD has become a partner in Plumb, Tuckett & Pilarsky, consulting engineers and architects of Gary, Ind., Chicago and Detroit. Mr. Laird, who has been chief engineer of the Grand Trunk Western Railroad, will be in charge of the firm's new office in Detroit.

CLARK A. DUNN, administrative head of the School of General Engineering, Oklahoma State University, Stillwater, Okla., is the nominee for the presidency of the National Society of Professional Engineers.

JOHN B. SAXE and BORIS LOCHAK have been appointed chief consulting engineer and chief engineer, respectively, of Gibbs & Hill, Inc., consulting engineers, Los Angeles, New York and Tampa. Both have been with Gibbs & Hill for a number of years.

SIGVALD W. STEFFENSEN has been appointed consulting engineer to the Borough President of Queens, New York City. Mr. Steffensen was formerly deputy director of the division of sewage disposal, Department of Public Works, New York City.

FARLEY GANNETT, Chairman of the Board of Gannett Fleming Corddry & Carpenter, Inc., Consulting Engineers of Harrisburg, Pa., died Jan. 20, in Washington, D. C., at the age of 77. A MIT graduate in 1902, he had a wide experience in all phases of public works engineering.

CHARLES W. SHERMAN, a retired partner of Metcalf & Eddy, Engineers, died at Cambridge on Jan. 17 at the age of 87. A graduate of MIT, in 1890, with SB in Civil Engineering, he received his SM degree there in 1891 and a MCE degree from Cornell University in 1893. He was principal assistant engineer with Metcalf & Eddy at the firm's founding in 1907 after having served in like capacity with Leonard Metcalf of Boston, the three years preceding. He retired as a partner in 1938 but continued his association with the firm as a consulting engineer until 1942. Mr. Sherman became a member of the ASCE in 1891, and a Life Member in 1935. He was a former President of the New England Water Works Association and was awarded the Dexter Brackett Award in 1922 for a paper entitled, "The Proper Term for which Water Works Bonds Should Run."

SOLUTIONS TO THE PARKING PROBLEMS

Progress in parking has been made in spite of discordance and difficult circumstances. From a broad outlook, most improvement has come from insistent pressures of the problem and from an increasingly realistic appreciation of probable consequences. Widespread efforts of considerable financial importance have been made in areas where the problem became acute and could no longer be ignored. In some instances, parking has significantly influenced national trends in finance, business, marketing, industry and living. For these reasons and the Eno Foundation's interest in all traffic problems, this publication is presented in the hope that it may contribute to continuing solutions, and that it may not only stimulate further studies of parking but form a basis for them. Write to The Eno Foundation, Saugatuck, Conn., for information on this 404-page book.

CONCRETE PAVEMENT CONSTRUCTION AND WINTER BRIDGE CONSTRUCTION

The first of three papers contained in this publication is by R. L. Peyton and presents in general terms the criteria which should be used in preparing plans and specifications for the control of modern concrete pavement construction. The second paper, by C. B. Laird, reviews briefly the past procedures on pavement construction in Michigan as they have led to the new pavement jointing techniques presently in vogue in that state. The third, by K. R. Scurr, describes the use of insulated forms to permit concreting operations on highway bridge construction to continue during subfreezing weather in South Dakota. Copies are 60¢ each and are available from Highway Research Board, 2101 Constitution, Washington, D. C.

CLASSIFIED ADVERTISING

FOR SALE

Ten thousand feet of 10" Transite pipe, new mostly 13 foot lengths, including Simplex couplings and rings, Class 150. Available in Thompsonville, Conn.

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DIRECTOR OF PUBLIC WORKS
Responsible to City Manager for engineering, streets, sewers, public buildings, cemeteries, refuse and, possibly water utility if qualified.
Salary open
Write City Manager, Zanesville, for details and application form.
Applications close March 15, 1958

ENGINEER WANTED
The City of Coatesville, Pennsylvania, desires the services of an engineer to assist the City Engineer. The position will lead, possibly in 1959, to City Engineer. If interested please address, Director Louis Apfelbaum, Esq., Department of Streets and Public Improvements, National Bank of Chester Valley Building, Coatesville, Pennsylvania.

Sewerage and Sewage Treatment

By COL. W. A. HARDENBERGH

Editor, Public Works Magazine; formerly Chief, Sanitary Corps, U. S. Army

AN authoritative yet simple treatment of the subject by one of the nation's foremost authorities. Col. Hardenbergh's editorial and field work have brought him in close contact with the problems that trouble the average engineer. And in this book he explains those methods most suitable for handling the work. Special attention is paid to sewerage systems, both storm and sanitary.

Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods.

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200 So. Broad St., Ridgewood, N.J.

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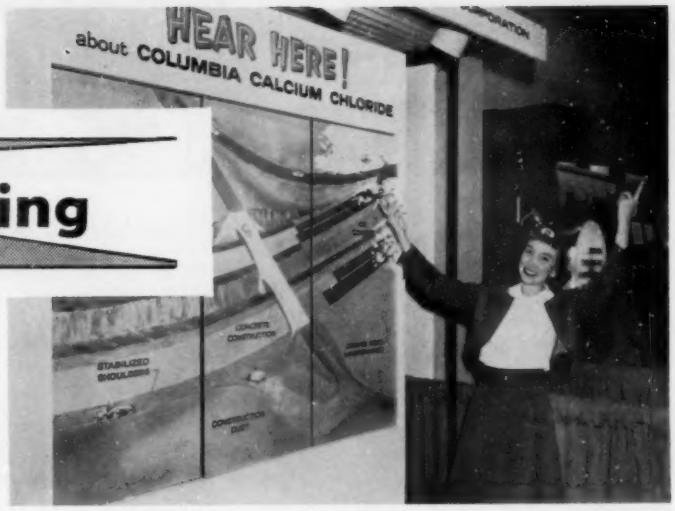
—Worth Seeing



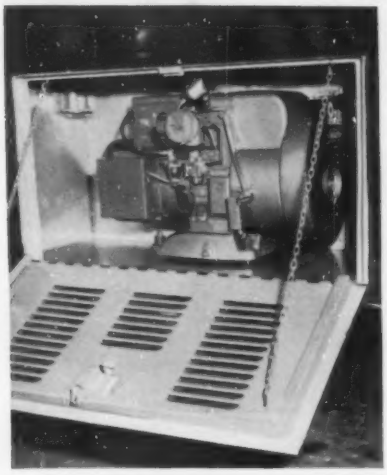
Those of you who were at the recent ARBA meeting in Washington will be happy to see lovely Joan Daley again as she pantomimes her pitch for Columbia-Southern's calcium chloride. Joan never said a word, but you could tune in on her message over a battery of phone receivers at the counter.

Massive 2,000,000 gallon elevated storage tank being built for the City of Tyler, Texas, is 195 feet to overflow. Design and tank wall prestressing by the Preload Co., Inc., New York.

It takes just two minutes to load the 6-yard truck with the new Model HU "Payloader" tractor shovel owned by Glenwood Springs, Colo. Unit also loads snow, digs roadside ditches.

Beauty and function combine at new Badger Meter Co. office building. Pool and fountain furnish water for use in plant.

ELECTRIC PLANT NEWS



Charges truck batteries at far less cost... provides A.C. power, too!

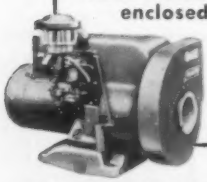
Before the dual-purpose Onan Electric Plant was installed on this maintenance truck, it was necessary to run the 160 H.P. truck engine to charge batteries used for communication. Now, the 2 H.P. Onan Electric Plant does the same job...saving fuel and engine maintenance.

The electric plant is an Onan Model 07AK-1R/972. It has an output of 750 watts A.C. or it can deliver 8 amperes for 12-volt battery charging. Plug-in receptacles are provided for operating electric drills, saws and other equipment used in construction and maintenance work.

Big savings reported!

One utility makes fuel savings alone estimated at $2.00 per day per truck. Another cites an annual saving of $800.00 per truck. This is based on battery charging output only. In addition, the A.C. output makes possible replacing hand tools with electric tools . . . saving time and money.

Vacu-Flo cooling permits enclosed installations



Vacu-Flo cooling is a low-cost optional feature on Onan air-cooled plants up to 10,000 watts.

Other Onan Models: 500 to 75,000 watts A.C., D.C. and Battery Charging

Write for folder showing 3 Packaged Power Systems

Onan ELECTRIC PLANTS

D.W. ONAN & SONS, INC.

3676A University Ave. S.E., Minneapolis 14, Minn.

by Arthur K. Akers

★ AMERICAN BITUMULS and ASPHALT CO. names Harry K. Burchfield to replace Woody K. Smith as St. Louis district manager. Mr. Smith goes to Atlanta as South Atlantic district manager.

★NATIONAL CLAY PIPE ASSOCIATION elects G. A. Robinson, president; Albert J. Reed, vice president.

★ MOVIES NOTE: "We Have Come a Long Way" is offered for associational meetings in 1958 by Howard R. Power of Flexible Inc., 351 West Jefferson Blvd., Dallas. It is 16mm, sound, color, 30 minutes, giving history and description of water and sewer main cleaning from Noah until now.

★ VULCAN MATERIALS CO., Birmingham, Ala., keeps growing. Now a Concrete Pipe Division has been formed, to promote and sell Cen-Vi-Ro concrete pressure pipe. President W. H. Blount of the new division will maintain offices in both Atlanta and Vulcan's new headquarters building in Mountain Brook, Birmingham.

★ CHARLES J. BREX, Jr., joins B-I-F Industries, Providence, R. I., as assistant advertising manager.

Mr. Brex

Mr. Cochrane

★ WILLIAM H. COCHRANE succeeds D. E. Broggi as president of Neptune Meter Co. Mr. Broggi continues as a consultant.

★ EDWARD E. BRUSH is elected vice president (sales) of Soiltest, Inc., Chicago.

★ MARVIN G. MAUDLIN becomes advertising manager, Sherman Products Inc., Royal Oak, Mich. Warren Henderson becomes sales operation manager. See Sherman ads in all PUBLIC WORKS Publications for details on their equipment.

★ UNION TANK CAR CO., Chicago, announces that Graver Water Conditioning Co., New York, has been completely integrated with Union. H. T. Sulcer, V. P. and G. M. and V. J. Calise, sales manager, remain at the Graver helm.

★ LEFT to right: James P. Dreiling, C. J. Workman, Bill Talmadge and John Vilven, new regional industrial sales managers, Massey-Ferguson Industrial Division, Wichita, Kans.

★ AMERICAN PIPE & CONSTRUCTION CO., Los Angeles, opens new administrative offices at 390 South Atlantic Boulevard. Southern California divisional offices remain at the plant location, South Gate, Calif. Subsidiaries include Amercoat Corporation and Pipe Linings Division.

★ UNITED STEEL FABRICATORS, Wooster, Ohio, promotes Ernest S. Infield to vice-president, sales; James Slater, to operating sales manager, Highway Products Division.

★ WILLIAM C. FLANDERS has been appointed general manager, Worthington Corporation's Gamon Meter Division, Newark, N. J. Andrew K. Richardson succeeds him as sales manager.

★ "HENRY is our best salesman," bragged his boss. "Why yesterday a widow came in to buy a suit in which to bury her husband—and he sold her one with two pairs of pants."

THE MAN WHO SAID *"No!"*

He's a business man looking for a place to build a new plant . . . a plant that will bring prosperity and growth to the community he chooses. Water supply is one of the most vital questions, and many a golden opportunity has been lost by a community because its water system is inadequate.

In Plattsburgh, N. Y., the story was different. Wasteful habits were causing water shortages, so Plattsburgh decided to install water meters. As a result, they "found" 1,400,000 more gallons daily . . . enough to supply a new Strategic Air Command Base now located there.

Even communities who have had meters for many years . . . but have allowed them to run down . . . can "find" more water simply by repairing the meters.

These savings are *real*. The meters give a strong money incentive for conservation. They help keep wells and reservoirs from running dry. The same filter plants and water mains may serve up to twice as many customers . . . with lower daily operating costs.

Your Neptune Trident meter representative will be glad to offer further evidence.

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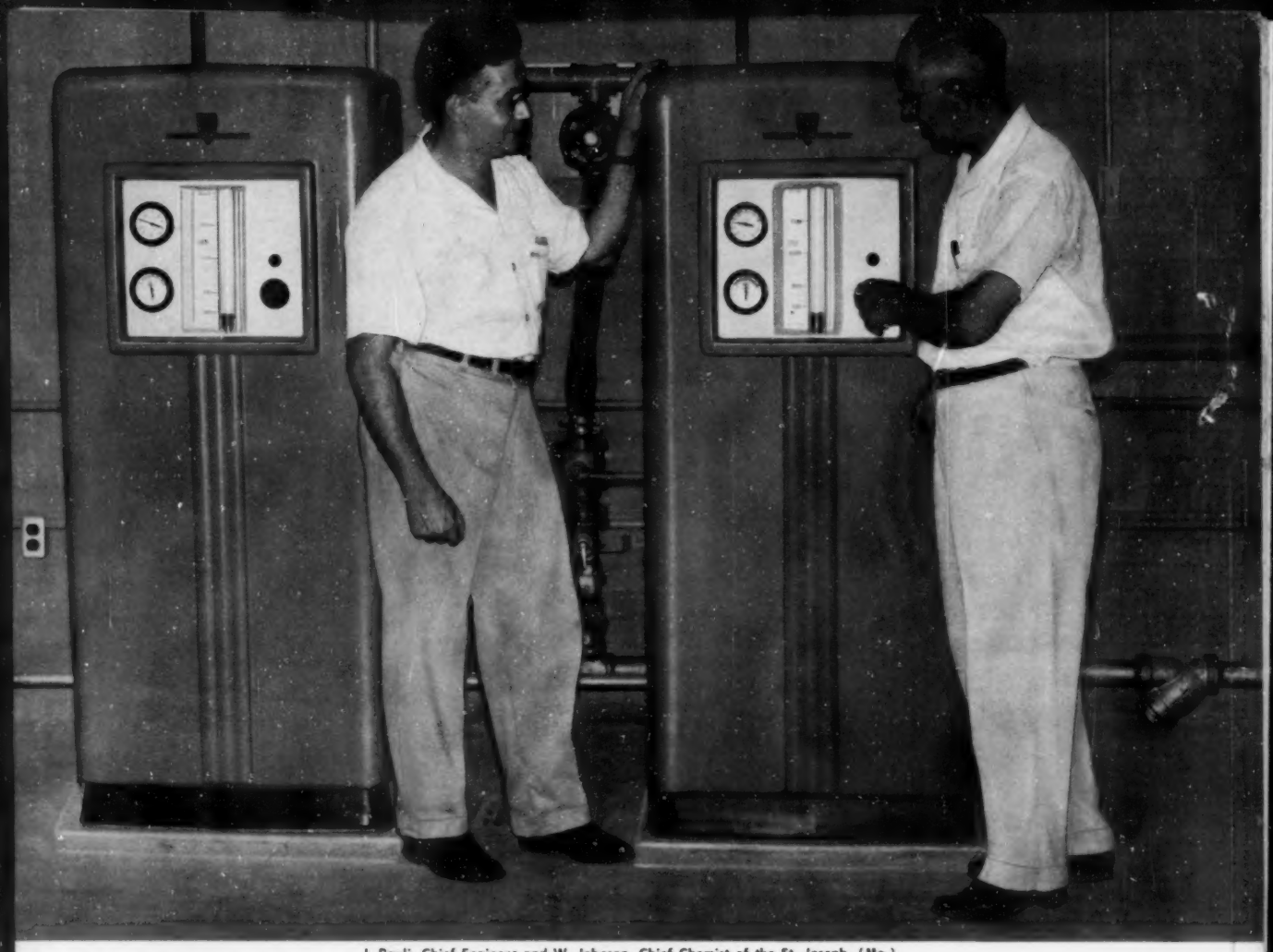
NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.

NEPTUNE METERS, LTD.
1430 Lakeshore Road • Toronto 14, Ontario

Branch Offices in Principal American and Canadian Cities.

neptune



J. Pauli, Chief Engineer and W. Johnson, Chief Chemist of the St. Joseph, (Mo.) Water Company, discuss operation of their W&T V-notch chlorinators. The St. Joseph Water Co. is part of the American Water Works Service Co., Inc. system.

W&T V-notch Chlorinators—
doubly accepted

The St. Joseph Water Co. found breakpoint chlorination the best way to treat Missouri River water. But this increased the range of chlorine requirements in the water treatment. **W&T** V-notch chlorinators were the answer.

W&T V-notch chlorinators have a chlorine feed range of 20 to 1 with an accuracy of 4%. Based on this acceptance at its St. Joseph plant, the American Water Works Service Co., Inc. has purchased V-notch equipment for use in other plants.

V-notch chlorinators are available to feed from 2½ to 8000 pounds of chlorine per 24 hrs. V-notch equipment also provides permanence and attractiveness through modern reinforced plastics. For comprehensive information about **W&T** V-notch chlorinators, write for Bulletin S-119.

WALLACE & TIERNAN INCORPORATED

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